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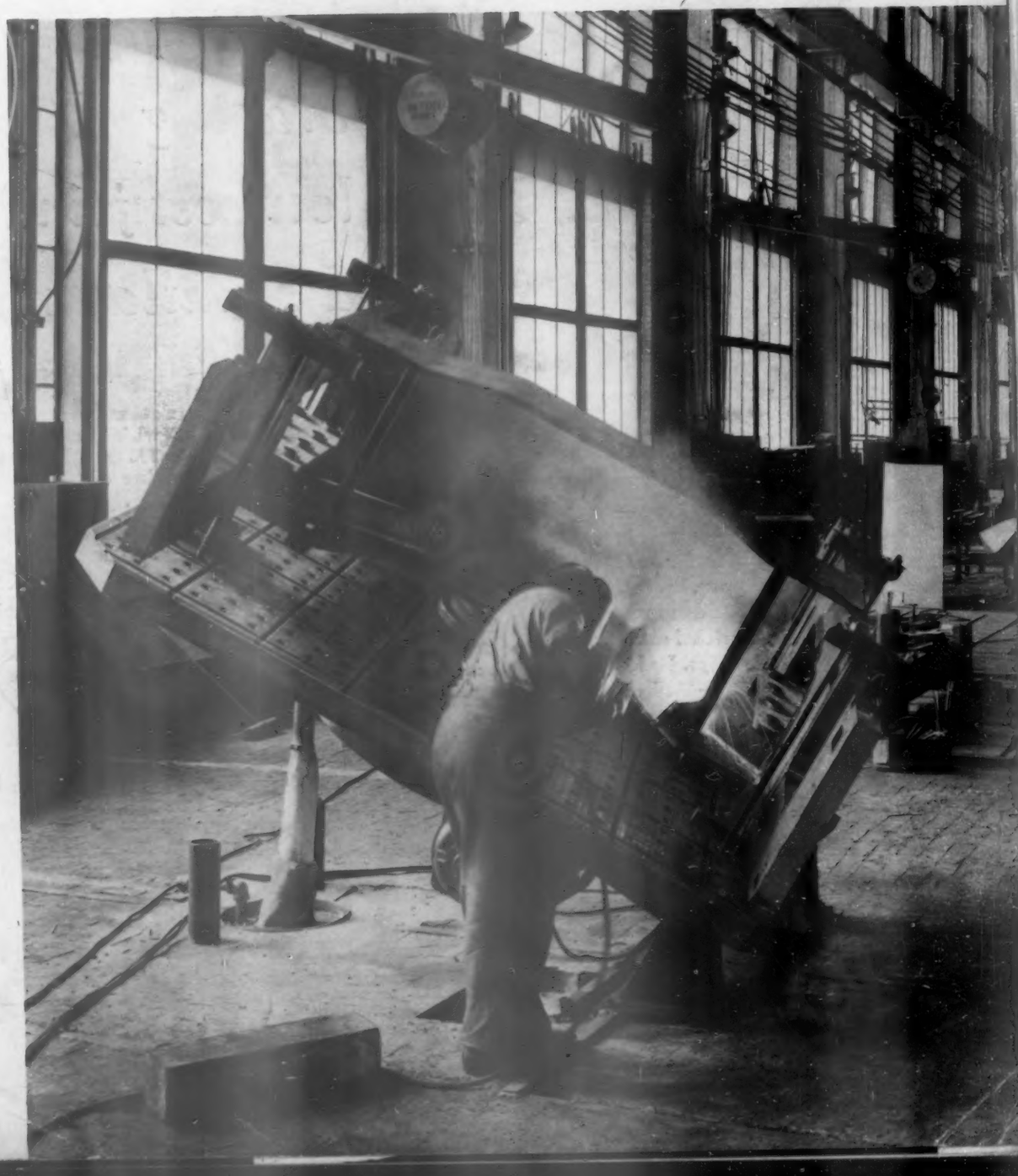

ME is saved and costs
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nufacture of locomotive
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table for welding,
e the operator can
weld in the down-
d position.

(See Page 42)

A troublesome job done ... EASY-FLO

—the low-temperature brazing alloy for low-cost joining of dissimilar metals

A ¾-inch yellow brass tube, a stamped circular body of steel only .015 inch thick—and a joint which must withstand constant vibration at temperatures up to 300 deg. F.—this was the problem in manufacturing this auto engine oil float.

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EASY-FLO offers high strength and economy in joining a wide variety of metals — steel, stainless steel, Monel Metal, Inconel, copper, brass, bronze, nickel and many other copper-nickel and chrome nickel alloys. Its low melting point—1175 deg. F.—makes it easy to guard against damage due to overheating. It flows rapidly, penetrates deeply, and offers good corrosion resistance.

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THE WELDING ENGINEER

Vol. 21, No. 12 DECEMBER, 1936

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EDITORIAL

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Nineteen Hundred and Thirty-Six

• The year just closing saw the 100th anniversary of the discovery of acetylene by Edmund Davy. He noticed that the gas burned brilliantly, and he termed the gas "bicarburet of hydrogen."

Though oxygen had been discovered by that time, it was exactly 50 years later (in 1886) that the first plant was built to make it in commercial quantities. The year 1936 was the 50th anniversary of that important event.

It was also in 1886 that Elihu Thomson took out his first patent on a resistance-welding machine, and it was just the year prior when Bernardos patented his method of welding with a carbon or graphite electrode, the arc being drawn between the electrode and the work.

These important anniversaries give the year 1936 a particular significance in the history of welding.

Though these events and discoveries alone did not make the welding industry, yet we honor those who made them possible and who supplied the germ of the idea that each represents.

And welding still carries on.

The year 1936 is also important for new and revolutionary ideas in welding.

The Longoria process, by which the thinnest of sheets are welded without distortion or buckling and perfect butt welds are made in fine wire cloth, was announced only a few months ago.

Also, several commercial installations of a speedy process for welding thick plates and slabs by a combination chemical and electric-resistance method, have been made in recent months.

Both of these processes involve principles that are as revolutionary, compared with conventional welding processes, as were those of 50 years ago compared with the blacksmith's weld.

It's a speedy age. Welding has gone far since the discoveries of 50 years ago. Yet we need go back only 20 years, to find an era which was ruled by the skeptic rather than the engineer. But when the God of War took the scepter, then the art of welding was pressed into emergency use. The apologists and skeptics quickly vanished.

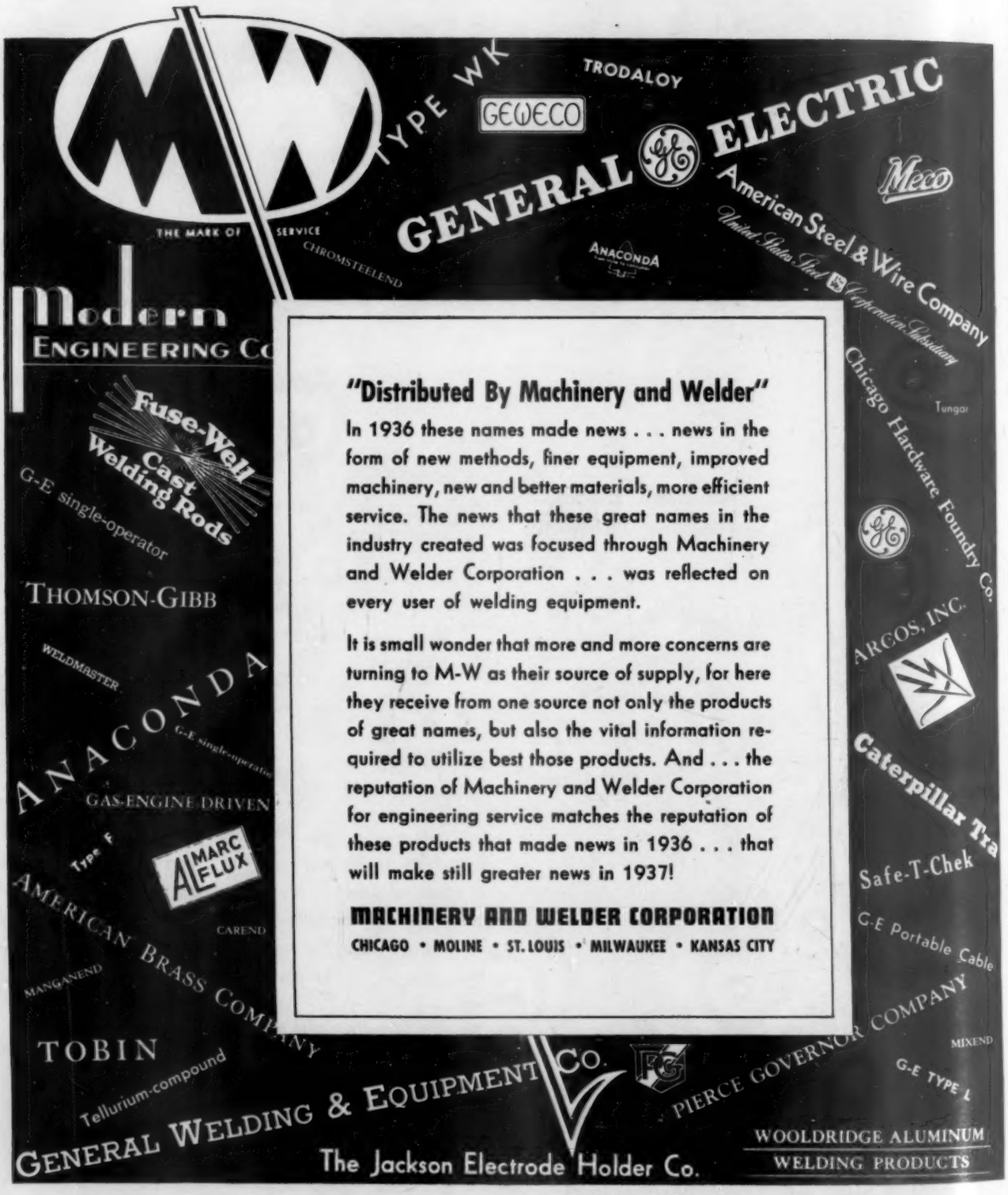
What a change has taken place! Our forefathers were skeptical of every new idea; now we embrace every brain child that is left on our front stoop without even an investigation.

But this is the year A. D. 1936!

NAMES MAKE NEWS!

In 1936 These Names Made Welding News

In 1937 They Will Make Still Greater News!



"Distributed By Machinery and Welder"

In 1936 these names made news . . . news in the form of new methods, finer equipment, improved machinery, new and better materials, more efficient service. The news that these great names in the industry created was focused through Machinery and Welder Corporation . . . was reflected on every user of welding equipment.

It is small wonder that more and more concerns are turning to M-W as their source of supply, for here they receive from one source not only the products of great names, but also the vital information required to utilize best those products. And . . . the reputation of Machinery and Welder Corporation for engineering service matches the reputation of these products that made news in 1936 . . . that will make still greater news in 1937!

MACHINERY AND WELDER CORPORATION

CHICAGO • MOLINE • ST. LOUIS • MILWAUKEE • KANSAS CITY

New One-Piece WILLSON

Welding Helmets and Handshields

Well Balanced
Sturdy --- Comfortable

The new welding helmet, cupped deeply to obtain close side protection to a point well back of the ears, permits unbelievably free head and neck movement. Protection from reflections and flashes from nearby work is provided by the full turned edges which run well back under the chin and above the head. The usual riveted, lapped-over seams have been eliminated; smooth rounded interior promotes air circulation and results in a well ventilated, cool, comfortable helmet. Adjustable three-position headgear and chin rest bar combine with improved design to make the most wear-worthy helmet we have yet found it possible to make. Rugged and strong, it will hold its shape and stand up under rough shop use and abuse. The helmet may be had with Flip-front or plain composition glass holder which will not warp or bend and is not affected by moisture or extreme temperatures.

One-Piece
No Seams
No Riveted Joints

More durable than any helmet or handshield you have ever bought for your welders, these new devices of one-piece formed strong black fibre employ an improved design to obtain a greater ruggedness. Improved methods of manufacture permit the use of heavier fibre with no increase in the weight of the device. To the handshield is riveted securely a grooved handle of proper size and shape to afford good grip and balance. Standard in the new devices is 2" x 4¼" WILLSON-WELD Glass, which meets all requirements of Federal Specifications and which is most widely used and best known for its unusual ability to cut off dangerous infra-red and ultra-violet rays of light. Write today for prices to Willson Products, Inc., Reading, Pa.

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This Job of Mine isn't all BEER *and* SKITTLES

NICK RODDER

MAYBE you think my job of roaming around the country, getting sour situations sweetened up is all beer and skittles. But I'm here to assure you that it isn't any skittles at all, on account of practically every shop boss has got his own ideas. And in fact, it often happens that let alone skittles, it doesn't even run to beer. For inst.

Here's a man hollering his head off on acct. of he has built a rectangular Monel* weighing tank for fatty acids. And is it a mess! They had used Sil-Fos silver solder. That tank is a living example of why,—admitting that Sil-Fos is perfectly swell for copper, brass and bronze—we don't advise it for Monel. Not that there aren't plenty of other good silver solders that work okay with lighter gauge Monel and Nickel, for which they are often preferred.

But, in spite of Tank No. 1, there's an order in the house for another, and the .062" Std. Monel sheet is on hand. Also for this job they get some 3/32" dia. No. 40 Monel gas welding rod and Inco gas welding and Brazing Flux.

The tank being rectangular, we set the joints up with corner welds, using a jig. It's nothing more than a steel angle with the sharp edge removed and outside angles held by "C" clamps. We mix the gas welding flux with hot water to make a thin paste and then paint it on the seam inside and outside on both edges. Also a little on the Gas Welding rod too. Using a slightly reducing soft flame the joint welds easy. The weld has a clean ripple weld appearance and the inside comes out clean and bright because of the flux. The ultimate result is a neat looking tank, no buckling to it, clean and square.

So when the boss of the shop sees what can be done by welding Monel he invites me to a place on the corner to have a drink. It's a drug store, and he takes a choc-malt. I says if it's all the same to him, I'll take a cigar.

And Can a Monel Weld Take It!

Every once in a while we get asked something like this, "Sure you can weld Monel, but what about the physical properties?" Last place they asked that one was on 3/8" and 1/2" Monel plate, arc welds. Also, would we come and see that there isn't any slip-up on the job.

We set up a butt joint—beveled 75°—and run in the first bead around 140 Amps. There was a uniform flux covering over the deposited weld metal (first bead) which was easily removed with a small hand tool. Subsequent beads are laid in, and where occasional chipping is needed this is done, but no peening is permitted or needed. The heat had to be reduced slightly—to 130 Amps.—because of warming of the plate. The underside is then chipped, a sealing bead laid in and the piece is ready for tests for the long-haired boys, using the same procedure as for steel, stress relieving, x-raying, machining and testing. The x-ray showed no signs of porosity or internal cracking, and later physical tests showed a tensile strength of close to 75,000 lbs. per sq. in. You can get some idea of the ductility from the free bend which gave an elongation of over 40% in the weld metal.

Test showed a tensile strength of 75,000 lbs. per square inch. The free bend gave an elongation of over 40 per cent in the weld metal.

Well, I won't say, after our tests are all run, that we didn't get any beer. No, I couldn't say that. But I be darn if I see so much as one skittle. I'm mentioning this to the engineer who shows me the weld bends and etc., explaining to him that a lot of heavy Monel equipment is being made every day by ordinary welding methods, and that it's easy if you know what's proper procedure and the right management of electrodes.

Then, ordering a 'nother couple of schooners he turns to me, "Say Nick," he says, "Welding Monel isn't any trick a-tall. But what bothers me is, what is a skittle?"

And wishing the same to you, I am

Nick Rodder

• • •

INCO WELDING RODS and FLUXES

for PURE NICKEL

Oxy-Acetylene . . . No. 41 Nickel Gas Welding Wire.
Metallic Arc . . . No. 31 INCO Nickel Metallic Arc Welding Wire.
Carbon Arc . . . No. 21 INCO Nickel Carbon Arc Welding Wire.

for MONEL METAL

Oxy-Acetylene . . . No. 40 Monel Gas Welding Wire. For flux see * at right.
Oxy-Acetylene . . . No. 43 Silicon Monel Gas Welding Wire. (For Sulphuric Acid Service.)
Metallic Arc . . . No. 130x INCO Monel Metal Arc Welding Wire.
Carbon Arc . . . No. 20 INCO Monel Carbon Arc Welding Wire.

for INCONEL

Oxy-Acetylene . . . No. 42 Inconel Gas Welding Wire. For flux see ** at right.
Metallic Arc . . . No. 132 Inconel Metallic Arc Welding Wire.

for NICKEL-CLAD STEEL (for welding of Nickel side)

Oxy-Acetylene . . . No. 41 Nickel Gas Welding Wire.
Metallic Arc . . . No. 35 INCO Nickel Metallic Arc Welding Wire.
Carbon Arc . . . No. 21 INCO Nickel Carbon Arc Welding Wire.

•

FLUXES

*INCO Gas Welding and Brazing Flux for Monel Metal.
**INCONEL Gas Welding Flux is recommended for Inconel.
No flux is used for the gas welding of Pure Nickel or Nickel-Clad Steel.

•

INCO welding materials as listed can most conveniently be obtained through regular INCO distributors.

*Monel is a registered trade-mark applied to an alloy containing approximately two-thirds Nickel and one-third copper. This alloy is mined, smelted, refined, rolled and marketed solely by International Nickel.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

The Welding Engineer

VOLUME XXI DECEMBER, 1936 NUMBER 12

Flame-cut Steel Plates Replace Cast Crusher Head

A NEW crusher head built up entirely of flame-cut plates welded together was recently installed at a plant of the Lincoln Crushed Stone Co., at Joliet, Ill., to replace a chilled-cast-iron head on a No. 8 crusher. The entire repair was made in place, without dismantling the crusher. The chilled-cast-iron head was 40 in. high with approximate diameters of 23½ in. at the top and 39½ in. at the bottom.

To remove the casting from the shaft the casting was cut in three places, using the electric arc, the cuts extending from the shaft to the edge of the casting and along the entire 40 in. length of the head. The whole job was completed in a remarkably short time.

Bevelled Plates Are Slotted to Receive Steel Shaft

After the casting had been removed from the shaft, a new crusher head was formed by welding in place a series of 4-in.-thick circular plates to the shaft. These plates were prepared by a flame-cutting machine with the outer edges beveled at the correct angle and each was slotted to receive the shaft. With the plate in place, the piece cut out of the slot was inserted and welded into position, thus making a complete disc. The completed crusher head consisted of ten of these plates or discs.

In assembling the plates, first the largest one was placed in position at the bottom and leveled and trued up and then welded in place. The piece cut from the slot was then inserted in place and

Electric-Arc Cutting in Progress.
(Three grooves were cut from the top to the bottom of the 40-in. casting. Care was necessary to avoid cutting into the steel shaft at the center.)

Damaged Cast Iron Head in Crusher.
(Dark mark on upper right side of corrugated surface shows where cut was started with the electric metallic arc.)

Flame-Cut Laminations in Place on Shaft.

(The steel shaft with key-grooves is plainly visible. Each circular plate is cut out to be fitted around the shaft, and then cut-out section is welded into the plate, and another plate placed above it, until the crusher head is entirely built up.)

The Built-Up Laminated Crusher Cone.

(After the plates were welded together, the outside was coated with hard-facing material purposely left rough to give added crushing effect. This surfacing is harder than the former cast iron, and won't break off.)

welded to the edges of the disc on each side. The second plate was then placed on the first and welded to the first plate along the edges of the slot, and the slot piece then inserted and also welded in place. This method was continued until all ten plates were assembled and welded. Each plate was placed on the one below in such a position that the center line of the slot made an angle of about 60° with the slot in the under plate. Thus the plates were moved 1½ times around the shaft in positioning them. Each plate was firmly keyed to the shaft in such a manner that it would be impossible for it to work loose. After the assembly of the crusher head, the lower half of it was coated with a hard-facing material.

Stone Crusher Out of Use for Only One Week During Repairs

The entire job was planned carefully so that the crusher was out of use for only one week. There was no additional cost to the crushed stone company for dismantling the plant, nor any interference with other operations. All other parts of the plant were in operation while this work was going on.

There are several advantages to this process of dismantling and assembling the crusher head. In the first place, it minimizes the interference with the operation of the plant, since neither the shaft nor any other part of the crusher has to be removed. Second, the new head, being fabricated of alloy-steel plate, is nondestructible and will last indefinitely. The hard wearing surface can be replaced as needed repeatedly for a very nominal cost. Should a digger tooth or some other iron body get into the crusher, the most it would do would be to dent the head, and such damage could be easily repaired by arc welding

Crushing Is More Uniform and Output Is Increased

The new crusher head is giving unusual satisfaction. The management of the Lincoln Crushed Stone Co. states that a more uniform product is being obtained than formerly, and the output has been materially increased.

A No. 7½ head has also been similarly constructed for the Moulding Brownell Corp. for their Thornton, Ill. plant. This head has not yet been put into service.

This new method of crusher-head construction was developed by the Equipment Reclamation Works, 532 W. 79th St., Chicago, Ill., who have applied for a patent on the method. The contracts for these crusher heads were carried out under the personal supervision of A. R. Gay, W. A. Owens, and J. W. Clayton.

Inspecting Their Handiwork.

(On the ground is a section of the cast iron head cut with the metallic arc.)

Credit Losses: or, The Hero Gets Revenge

By C. J. HOLSLAG

President, Electric Arc Cutting & Welding Co.

The several acts of this drama are true. In the prologue, a stream of traffic is moving along a bridge—from production to buying. Some fall off into the stream and are lost—temporarily. But when recovered, they can't be moved back against traffic except with great difficulty. The traffic that falls off the bridge can be likened to credit losses in any business.

In the first act, a company which is easy-going in its credit, losses the sale of a welding machine by being a little too careless about credit. The prospect goes elsewhere and purchases another good machine for cash to show them that he has the money and doesn't need nor want credit.

In the second act, the customer meets the shipment at the freight station in an Ohio city. He evidently has his worldly possessions on a truck, for after he obtains the welding machine he is *spurlos versenkt*. He shakes the dust of Ohio from his feet and is nowhere to be found. One morning the shipper receives a letter from Texas, the writer explaining that he has one of the shipper's machines which has been in a wreck and he wants some spare parts. But he gives the serial number, which the shipper recognizes as belonging to the stolen machine. It appears that the Ohio man went into business in the South and used the machine as his half interest. The shipper explains the situation to the honest partner, and he pays the balance that is due on the machine.

As the curtain rises for the third act, we witness an interesting chase which starts in Minneapolis. Each time the pursuer catches up with the culprit, the latter does the disappearing act with the truck and the welding machine, which belongs to the pursuer. The fellow with the machine earns enough money at odd jobs to keep going, so he doesn't have to stay in any one place long. He is chased through seven states by means of the description of his car and the license that he has to take out once in a while. At last, he is nabbed while working on the Coulee dam in Washington, where he is put in jail and the owner gets his machine back. The fellow, when he gets out of jail, will probably work the same trick again—but not on the first "sucker."

There are those who try to pull the same trick twice on the same company. A fellow in North Carolina was chased until he was caught up with and the machine taken from him. Soon the company who "bit" the first time received a letter signed with a different name and mailed from a different location, but the fellow's handwriting was recognized. He must have liked the machine, but he was told that, if it was the same to him, they would prefer that he would spread his attentions.

In the next act, a man in Brooklyn disappears with a machine before it is paid for. Investigation shows that his wife's people came from Connecticut. With that as a clue, he is soon located—With much embarrassment to himself and his "in-laws." He pays up, so keeps the machine.

Now comes the best acting in the drama. A machine is shipped to Washington, D. C., on a conditional sale, and the customer disappears with it. He can't be found in person, but every time he is billed for what he owes, he says he is not himself but his brother, and he will tell his brother about it, etc. The complainant in disguise puts in several long-distance party calls for the fellow to surrounding towns. About the third time, his familiar voice is heard and he has the usual alibi, that he is not the other fellow but his brother. So the complainant begs his pardon, finds out the address to which the call went, and at 2 o'clock that morning the machine is taken away from the fellow in Norfolk, Va.

Next, we see a fellow in Chicago who is such a bad actor that he deserves special recognition. In that big city, he eludes his pursuers for several months, but soon, as things get too hot for him, he disappears. He is finally located in Wisconsin; but since he won't tell where the machine is he is put into jail. After four and a half days spent behind the bars, he agrees to show where he has hidden the machine. It is found thirty miles out in the country, behind a barn and covered with cornstalks.

Then we see the final act, which is the best one of all. A fellow in Brooklyn goes to the manufacturer and buys a welding machine on conditional sale. He takes out a loan on it, and the man that loaned the money files his claim fifteen minutes before the seller can get there with his claim. Within forty-eight hours the buyer sells the machine to a party in the Bronx. Of course, this sale is illegal, so the original seller gets his machine back, but is required to pay the mortgage.

The final curtain falls as the chorus sings, "We Always Get Our Man, Be He White, Black, Red or Tan."

British Issue Standards on Oxyacetylene Welding

A new British Standard Specification, known as No. 693, is devoted to "Oxyacetylene Welding of Steel Structures" and is complementary to B S.S. No. 538, issued in 1934, on "Metallic-Arc Welding of Steel Structures." It lists requirements for making welded joints, gives the maximum working stresses permitted, and describes the workmanship and flame conditions to be maintained and the tests to be carried out. Copies of the new specification can be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W. 1, England, at 2 shillings, 2 pence each.

Oxyacetylene Committee Issues New Booklets

Three new booklets, entitled "Heating by the Oxyacetylene Process," "Design of Jigs for Oxyacetylene Welding," and "Hard-Facing by the Oxyacetylene Process," have been published by the Oxyacetylene Committee of the International Acetylene Association, 30 East 42nd St., New York, N. Y.

The booklet on heating discusses some of the uses of the oxyacetylene flame for local hardening, annealing and stress-relieving. Examples are also cited where the heat of the torch is used for bending and straightening. Information is given on heat-treating rail ends. Sections of the booklet are also devoted to low-temperature brazing and the making of slip-type brazed pipe joints. Many applications of the air-acetylene flame are listed and described.

In the booklet on jig design, valuable suggestions are given on positioning and holding work for welding. Jigs for many different purposes are described and many applications illustrated. Design fundamentals are discussed, and information is given on controlling expansion and contraction.

Applications of hard-facing have been made to solve a great variety of problems, on many different kinds of equipment, and a number of these are discussed in the third booklet mentioned. The reader is given aid in selecting the right kind of hard-facing material for the particular job, and procedures are described for applying hard-facing materials to various metals and alloys.

Builds Business in Welding Damaged Toys

A good business in welding broken toys was done this past year by the R. Michels Welding Co., 722 Washington St., Covington, Ky. This concern employed newspaper advertising effectively in promoting this type of business. A typical advertisement of theirs is shown.

Welded Stainless Steel Finds Favor in Notable Kitchens . . .

By EDWARD H. SYKES
Pittsburgh Correspondent, *The Welding Engineer.*

WELDED stainless-steel sinks, fabricated by the Tracy Manufacturing Company, Pittsburgh, Pa., and recently installed by the Excel Metal Cabinet Co., Jamestown, N. Y., add a modern note to the White House kitchens in the nation's capital. This is just one of hundreds of unusually interesting installations made throughout the United States for which the Tracy organization has become nationally famous.

The accompanying illustrations give two glimpses into the kitchens of the executive mansion in Washington. Counter tops and sinks, as well as the steel cabinets and dishwasher, were all fabricated from stainless steel.

In commenting upon the application and striking beauty of stainless steel, ingeniously butt welded into kitchen sinks, an executive of the Republic Steel Corp., who supplied this steel, states:

Stainless Steel Impervious to Kitchen Alkalies and Acids

"In the manufacture of its Silvi Sheen line of stainless steel sinks, the Tracy Manufacturing Co. realizes that perfection must start with raw materials, and therefore specifies high-grade sheets that possess flatness, perfection of finish, uniformity of gauge and workability. These stainless-steel sheets are fashioned into sinks to fit the widely varying shapes and sizes of spaces to be found in the layout of modern kitchens. They offer a surface impervious to the action of acids and alkalies encountered in kitchens. Stainless-steel sinks remain bright, free from tarnish, and require a minimum of attention.

"The Tracy design, achieved through the proper choice and emphasis on straight lines, small radii and flat planes, brings out the lustrous beauty of the stainless-steel sheets. That such products should find their way into some of the finest residences in the world, is not surprising.

"One of the most notable of Tracy's recent installations includes all the sinks and counter tops in the White House kitchens. Congress has been in the habit of appropriating money for the remodeling of these kitchens no oftener than every twenty or thirty years; hence, the construction must be sound and of lasting quality.

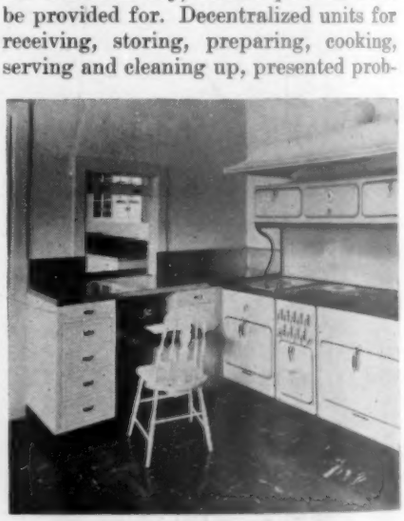
"In addition to the architectural and technical problems involved in the fitting of modern equipment to walls of 30-in. solid stone, it was necessary to provide for widely divergent social and entertainment requirements of the 118-year-old presidential mansion. Facilities for cooking dozens of chickens and bushels of vegetables must be kept in readiness. On a normal day, 60-odd persons must be provided for. Decentralized units for receiving, storing, preparing, cooking, serving and cleaning up, presented problems for the architect and for the Tracy company alike.

"Stainless steel also was used by the Tracy company in the fabrication of nine sinks for private apartments in the Russian Embassy at Washington, D. C. In the remodeling of this palatial residence about two years ago only the very highest quality materials were used.

"Listed among these residential installations are those for Mrs. William Rockefeller, Mrs. Clifford Heinz, Frank

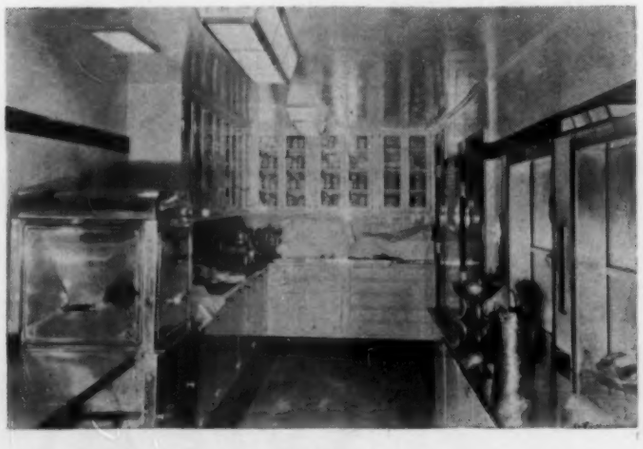
Pantry In the White House at Washington, D. C.

(Stainless steel is used on counter tops on both sides of this corridor. It will have to last for thirty years—until the next Congressional appropriation.)



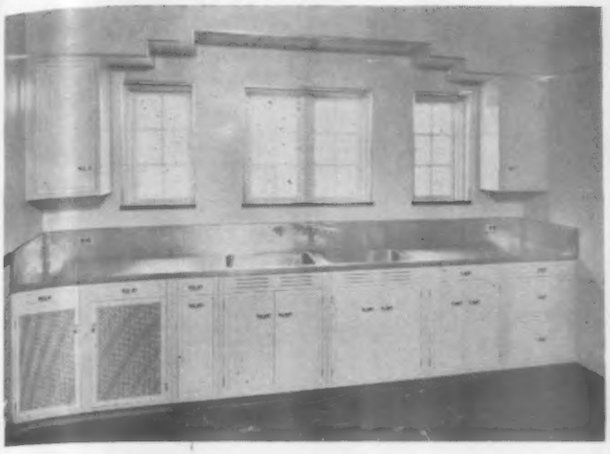
In the Heinz Home, Pittsburgh.

(This shows a counter top and planning table in the kitchen.)



View in One of White House Kitchens.

(The oven, the window frames, even the ceiling light frames are made of stainless steel.)



A Sink in the Heinz Kitchen.
(This is made of welded stainless steel with an 8-in. back.)

Steel and Linoleum Sink in Heinz Home.
(The steel and linoleum are bonded together by a novel process.)

Jay Gould, George Mason, and a host of other well-known persons.

"This company also makes cabinet sinks and work surfaces which entail the application of linoleum to a steel base, using hot-rolled stretcher-leveled sheets. The linoleum, bonded to the steel and held firmly by a patented process, forms the drainboard and the backsplasher. Stainless-steel bowls and edgings form a practical and delightful contrast to the linoleum.

1,000 Low-Priced Sinks Bought for Home Building Project

"Lest the impression be gained that all stainless-steel kitchen equipment is definitely 'high-hat' in character and find their way only into the most luxurious settings, it should be remembered that one thousand moderately priced Tracy sinks were used in the Bayside Hills Development in Long Island, N. Y.—one of the largest home-building projects in the country."

Thomas D. Goodwin, general manager of the Tracy Manufacturing Co., is particularly proud of two 158-in. sinks recently installed for a prominent soup manufacturer of Camden, N. J., these being 25¼ in. deep. Another extra-long all-welded sink, made of 18-8 stainless steel, was installed for the H. J. Heinz Co., of Pittsburgh.

Other recent important installations include those in the home of Mrs. Clifford Heinz, relative of the famous food manufacturer, and in commenting upon them, Mr. Goodwin said:

Stainless Steel Sinks Are of One-Piece Welded Design

"The stainless steel pieces are of one-piece welded construction, the sink being a very large two-bowl unit with integral back and ends, all joints being welded and finished to match the Tampico finish given the sheets by the mill. The planning desk beside the stove extends halfway through the opening into the pantry, where it adjoins the Perma Sheen linoleum-composition-cabinet top.

"The Perma Sheen Deluxe sink and cabinet tops have stainless-steel trim, which is welded in position and finished to match the Tampico finish of the trim.

"The choice of stainless steel for the kitchen, where the sinks and counter tops receive severe usage, and linoleum composition in the pantries, where the fine glass- and chinaware is handled, represents the most efficient use of these materials in the home."

Where the stainless-steel trim joins the linoleum, it is "sealed" in the linoleum tops; that is, it is welded or "sweated" in and the linoleum is rabbeted to bring it flush with the metal. The linoleum is held to the rolled-steel base by a special cement. The bowls are die-drawn out of cold sheets, and 14-gauge hot-rolled steel is employed for the tops and welded without buckling.

Appraisal of Arc Welding at the Year's End

By O. A. TILTON.
Electrical Welding Engineer, Industrial Dept., General Electric Co.

The year 1936 has seen the actual preparation for a sound prosperity in which low manufacturing costs—and then higher profits and certainly greater volume of sales—are being made possible by a more extended and more intelligent application of welding. Perhaps there is an analogy between industry and the individual, in that periods of adversity cause each to take account of his assets, determine his previous errors of judgment or practice, and lay out a new plan for the future—avoiding the pitfalls of earlier experience. The depression from which we are now emerging has, it appears, reacted similarly upon industry. It has forced a search for other, more economic ways of doing things.

In the early years of reduced business activity, industry as a whole began to consider seriously, almost for the first time, those economic opportunities offered by the use of welding. As a result, there followed a period of transition. Now, however, things seem to have settled down. Where the pendulum had swung too far, it has been reset to a saner amplitude; where it had not been given sufficient impetus, the required additional forces have been applied.

A few examples of stabilized welding practice are:

1. A realization that machine welding is an economy over hand welding only when a proper balance results between the labor and material cost and investment.
2. High welding speeds must be balanced against quality of weld material.
3. High welding currents and large-size electrodes often accomplish nothing but increased power and material consumption, and frequently impair quality.
4. The chief advantage in the use of alternating current for welding is the practical elimination of magnetic blow, rather than a differential in first cost that sometimes exists in the welding units themselves.
5. There are still many entirely proper applications for bare or lightly coated electrodes. The heavily coated electrode can frequently justify its greater cost by providing a very necessary improvement in quality as well as increased welding speed, but this is by no means universal.
6. Each welding process has its distinct advantages. Many of these processes overlap as to possibility, but usually not as to economy of application.

Of these, perhaps the most important that 1936 has seen realized is that high welding currents and large-size electrodes are generally not an economy. Perhaps a peak has been reached in these factors, which will not be exceeded until new welding processes not now known are brought forth.

Hardening Cast or Rolled Steel

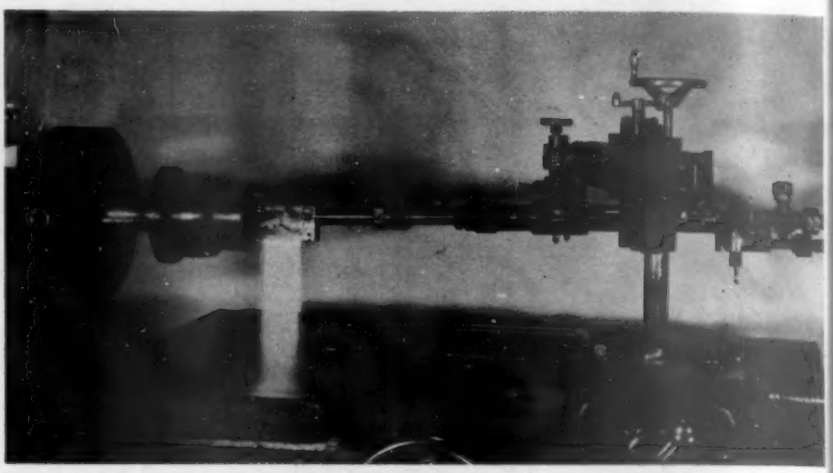
With the Oxyacetylene Flame . . .

By G. V. SLOTTMAN
Air Reduction Sales Co.

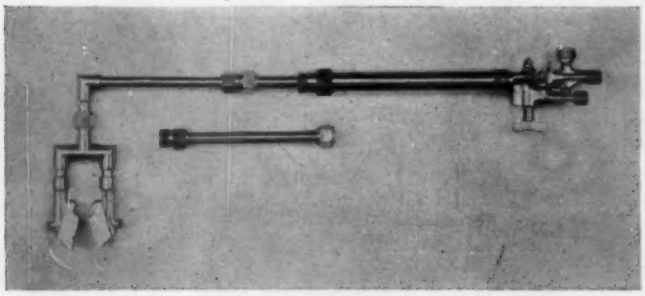
STEEL can be hardened from the as-cast or as-rolled condition by heating above its critical range and rapidly cooling, the degree of hardness obtainable depending on the steel analysis, on the temperature to which the steel is heated, and on the rate of cooling.

The operation of steel hardening simply requires a means for heating the steel above its critical point and then rapidly quenching it. There is no difference in the hardening effect obtained, whether the part be heated in a furnace or with the oxyacetylene flame, provided the steel has been brought to the same temperature and has the same degree of penetration of heat into the interior, and provided a consistent quenching procedure is maintained.

Furnace hardening of steel has been practiced for a long time, particularly for the bulk hardening of small objects which are to be uniformly hardened throughout their mass.



Multiflame Hardening Torch With Quenching-Water Spray.
(Two rows of 11 heating flames are visible against the background of the curtain of water issuing from the quenching holes. In this case, the torch is mounted on a lathe carriage, and the part to be hardened is rotated on the lathe spindle.)



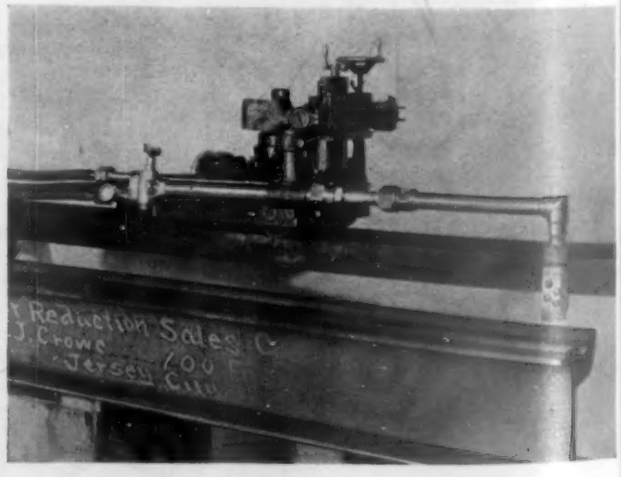
Duplex-Head Torch Designed for Hardening Gear Teeth.
(The straight connection can be substituted for the 90° extension tube.)

For such purposes, furnace hardening undoubtedly costs less than hardening with the oxyacetylene process. However, in a number of cases where the pieces to be hardened are of considerable size, one cannot prevent distortion of the hardened piece when furnace heated. Numerous applications require hardening of only a small portion of the total surface of large objects. In many instances where single objects are to be hardened, the expense of lighting a hardening furnace is not warranted. The oxyacetylene process of flame hardening is becoming recognized as a simple, inexpensive method of solving hardening problems such as these, and a wide field of application is developing as experience with oxyacetylene hardening is gained.

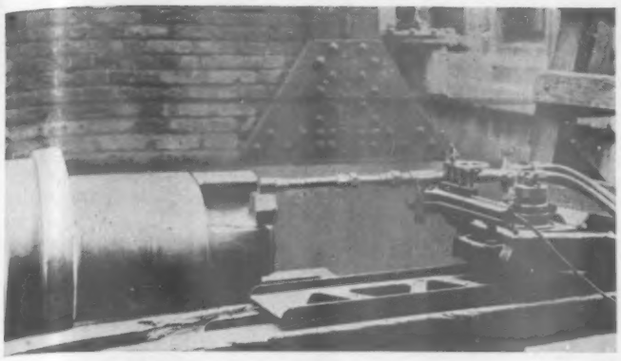
The use of the oxyacetylene flame for hardening objects dates back over a considerable period, and there are no basic patents limiting promotional efforts in this field. Certain specific applications of flame hardening have been patented, but the scope of these patents is in general so limited as to impose little restriction on the active development of flame-hardening apparatus and procedure.

Torch Can Be Held in Hand or Mounted on Cutting Machine

Flame hardening can be done by hand with the standard welding or heating torch, so the principle of this operation can be demonstrated readily in the field by using standard equipment. For automatic operation, the welding or heating torch is mounted on a cutting machine



Flame Hardening Torch Mounted on Torch-Machine Carriage for Selective Hardening Operations.
(This application of the multiflame torch is for hardening grooves in street-car rails, for use in noiseless crossings, where the car wheel rides on the flange instead of on the rim.)



Flame-Hardening Torch Set Up for Hardening the Wabbler of a Steel Roll.

(The multiflame tip is specially designed for this purpose. The torch is mounted on the trolley of a straight-line cutting machine. Reproducible hardening effects are easily obtained by maintaining constant the motor speed, and oxygen, acetylene and water pressure.)

and made to follow the contour to be flame hardened, at a fixed rate of speed. For shop production, as in hardening gear teeth, the carriages of lathes and other metal-working machines can be adapted to carry the torch.

To supplement the simple welding or heating torch for flame hardening, certain other pieces of equipment have been developed, including double-flame tips, flame-hardening torch, mixers, 90° extension tube, straight extension tube, and adjustable and universal yokes.

The two-flame hardening tips are made of annealed copper. The tips can be bent at sharp angles, making them suitable for the simultaneous hardening of both faces of small gear teeth. They are used with one of the standard torches.

Water-Cooled, Multi-Flame Tips Heat Broad Areas

Application involving the heating of a broader area have required the development of water-cooled multiflame tips consisting of a solid brass or copper block containing a number of fine holes as heating orifices. These tips are generally provided with a row of quenching holes following the heating holes, passing either water or compressed air for the quenching stream. Multiflame tips are not carried as stock items, since their size and the spacings of heating and quenching holes must be determined for the particular job in hand.

The steady increase in the number of applications of flame hardening is in large part due to the desire for better-quality products. A list of all the various applications of flame hardening would involve the entire machine-building industry, since wherever the selective wear of a machine part is present, there is a possible application of flame hardening.

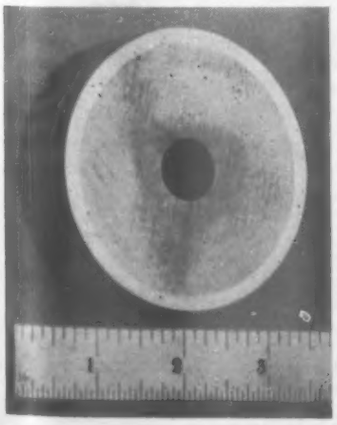
Gears of the herringbone, spur, spiral, bevel and sprocket types have been successfully hardened. Machinery shafts and crankshafts at their bearing surfaces, cams, steel-mill-roll necks, wabblers and similar parts subjected to sliding friction, can be hardened. Railroad and crane rails, street-car rails for crossings, curves and car stop points offer possibilities. Guides for machine tools, planer tools, drilling heads, locomotive cross-heads, backing-up plates, liners, punching and forming dies, ball races, cutting edges of shears and pliers, can be mentioned to illustrate the potential field of application of the flame-hardening process.

In approaching a flame-hardening problem, the first point to bear in mind is the suitability of the steel for hardening. Where the steel composition is such that satisfactory hardening cannot be obtained, it is possible in many cases to adjust the analysis of the machine part to make flame hardening possible. The part in question may be of such a nature that it is more easily and economically furnace hardened, in which case it is a waste of time to attempt to develop oxyacetylene flame-hardening procedure. The part having been considered suitable for a flame-hardening operation, it is possible that the standard two-flame heating tip, either hand or machine guided, can be used, quenching being done with a suitable medium, generally water or compressed air.

Where a broad flat strip is to be hardened, or a surface of irregular contour such as the tooth of a gear or the bearing guide of a machine tool, special tips must be designed. Similarly, in cases where the steel analysis is such that special hardening procedure is indicated, development work in the laboratory will be required. Dimensioned drawing indicating the areas to be hardened, the

Cross-Section of a Gear Tooth Flame Hardened, Showing Progressive Rockwell Hardness.

(The hardness varies from Rockwell C-18 in the untreated center of the tooth to Rockwell C-59 at the wearing surface. The penetration of the hardening effect is observable to a depth of 3/16 in., with a uniform tapering of hardness, desirable in preventing spalling of the hardened surface under shock.)

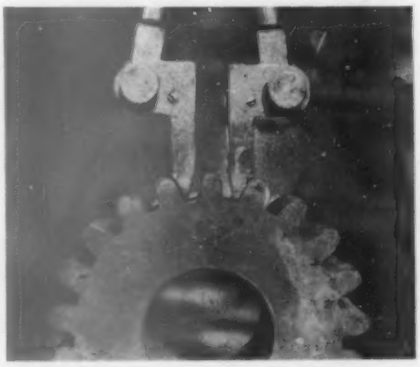


Showing the Hardness Case Produced by Flame Hardening a Steel Disc.

(The flame hardening torch was set up on a lathe carriage, the piece to be hardened on a mandrel, and the lathe spindle was rotated one revolution. The slight overlap caused by the starting and finishing off is barely discernable at the top of the object. In this case, an auxiliary quenching stream was directed against the work forward of the heating flames to prevent the flow of heat ahead of the tip from annealing and reducing the hardness of the portion already treated.)

Set-Up for Flame Hardening Gear Teeth.

(Here the torch is mounted on the carriage of a straight-line cutting machine. A universal yoke is used to carry the gear-hardening tips.)



Close-Up View of Gear-Hardening Set-Up.

(Both sides of the tooth, located between the two tips, are simultaneously treated, with consequent reduction in distortional effects. The heating holes are arranged in a vertical row, to play at right angles to the face of the gear tooth.)

depth and degree of hardness desired, the steel analysis and, if practicable, a suitably sized specimen of the material for hardening trials, are desirable, and will facilitate the solution of the particular problem.

Wire Association Award Presented to Notvest

The Wire Association award for the "most meritorious contribution to the literature on the wire industry during the year 1936" was presented to Robert Notvest, chief engineer, Welding Division, J. D. Adams Co., Indianapolis, Ind., for his paper, "Steel for Arc-Welding Electrodes," which he read before the annual meeting of the Wire Association, held in Cleveland, O., Oct. 19 to 23. This is a signal honor in recognition of the worth of Mr. Notvest's presentation and discussion of the metallurgical and thermal factors having a bearing on the characteristics and properties of the weld.

Robert Notvest.

Welder Solves Hay-Baler Problems

By JOHN T. BARTLETT

Recently Jack Holmes, a welder in Boulder, Colo., placed a hay-baler on pneumatic tires, and eliminated vibration in the later. How he did it is told by Ray Austin of Boulder, a large operator in the baled-hay trade.

Holmes took the two front axle assemblies of a Model A Ford, one for back, and one for front, and welded a yoke under the two stringers, so that the wishbone could brace the two axles. The he took the front cross member out of a Model A truck and welded that between the two stringers.

The new light-weight chassis, with pneumatic tires, supplants a much heavier chassis. The new mounting eliminated vibration and is expected to add many years to the life of the hay-baler.

Welding gear-wheels 38 in. in diameter is one of the "chores" calling for more than ordinary skill, that Holmes performs from time to time for the hay operator.

A LETTER

Editor's Note: Of the thousands of letters that are received every year from our readers, we single out one occasionally for publishing. Here is a letter that is provocative of constructive thought and is from one who has been signally honored by his associates in the American Welding Society. We commend Mr. Gibson's letter to our host of readers for study and consideration.

The Welding Engineer,
608 South Dearborn St.,
Chicago, Ill.

Gentlemen:

There have recently come into my hands the practically completed specifications of the American Welding Society Nomenclatures' Sub-Committee on Welding Symbols. I devoted an evening at home to the study and consideration of this report. This excellent work on standard welding symbols set me to thinking of America's industrial acceptance of welding.

Within the last few weeks I had the privilege of visiting a plant whose work in welded pipe and fittings was outstanding. This last week I spent an afternoon looking over what one of our major central power stations had done in welding large high-pressure, high-temperature steam piping. Some time ago I saw the building of enormous hydraulic turbines by welding in a shop which, until this particular contract was taken, had not used welding in its fabrication of equipment.

During these visits I talked with the management, the superintendents, the welding supervisors and the welders. I asked innumerable questions regarding their procedure, their technique, their control, their qualification of operators, their heat-treatment, their inspection, and the relation of the cost of their products made by welding in comparison with their previous methods of fabrication. One thing impressed me in each instance: the exact knowledge of every step in their work, the exact control exercised, the standard practices from which they never deviated. These were the rock foundations upon which they builded; these the reasons for their success. My thought then turned to those scores of welding shops where it is considered that the purchasing of welding equipment and supplies and the hiring of operators constitute a weldery.

Those of us who are concerned with the advancement of the art of welding, and the "Welding Engineer" is in the front rank of these, cannot close our eyes to these diametrically opposed principles of operation. We have not yet lived down the disastrous results of past years' welding failures. We are still faced with the deadening reaction resulting from present weldments made with inexperienced, unqualified operators, poor equipment and supplies and even more inexcusable, inexperienced supervision. With the rise of any new method of fabrication there is bound to result enthusiasm, extravagant claims, uneconomical decisions in design and—of more serious portent—faulty judgment and the human element or lack of skill which leaves in its wake costly failures and disappointments.

These are the conditions which those of us intensely interested in the development of the art of welding are striving to correct. These are the conditions which the American Welding Society, through its work on codes of procedure, in its standard qualification of operators, in its research, collaborating with the Engineering Foundation, our technical educational institutions and industry, is endeavoring to overcome by giving to America, scientific and exact knowledge.

Regardless of propaganda, of advertising, of high-pressure sales effort, industry will find its production crystallizing into the fabricating method and the use of those materials which produce the most serviceable equipment at the most economical cost.

The best interest of the development of the art of welding lies in the exact knowledge which guides our production to the utilization of welding where that best serves industry, to the utilization of riveting or castings where these best serve industry. With the dissemination of knowledge, with the proper control of procedure, with expert supervision of skilled workers, we will produce America's fabricated products at the lowest cost. In this way, and in this way only, will there be attained for all that "more abundant life" which politicians propose pulling out of silk hats.

It is hoped that industrial America will give to its welding problems the same research, the same experimentation, the same thought and study which has played so important a part in the development of riveting and casting.

The scope of welding is so large, the developments so inviting, the commercial possibilities so outstanding, that industry cannot afford to perform its welding by rule of thumb and guess work.

The automotive industry, the refrigerating industry, the electrical industry, the pressure-vessel industry, have shown what research and exact knowledge and control of procedure can do for the development of welding. The fields of other fabricators are equally inviting. Our smaller industrials cannot, of course, afford the cost of extensive research. That is why the broadcasting of knowledge is so important a duty of the American Welding Society and your own splendid "Welding Engineer."

We appreciate your help and encouragement in our efforts to build a larger and more effective American Welding Society. Our efforts will be tireless to bring order, control and scientific knowledge to those in the welding industry. The accomplishments which we shall make this year will, I am sure, be pleasing to you.

Very sincerely yours,

A. E. Gibson,
President,
American Welding Society.
7000 Central Ave.,
Cleveland, Ohio.

Welding 3½%-Nickel Steel

Abstract of paper delivered before the St. Louis Welding Society, October 9, 1936.

By EDWARD J. BRADY
Joseph T. Ryerson & Son, Inc.

THE use of nickel for alloying purposes in steel has enjoyed a very rapid development in the last few years, and there are today more than 1,000 trademarked alloys containing nickel. The discussion in this paper will be confined to the variety falling in the range of 2% to 5% nickel, with a maximum carbon content of 0.40%, and will stress in particular the so-called 3½%-nickel steels, more closely defined as the S.A.E. 2300 series.

Corrosion-Resistant Steels of High Yield Point

The 3½%-nickel steels are outstanding in their dependability, due in no small measure to their simplicity in composition, involving the addition of only one non-oxidizing element to high-quality steels. Extensive atmospheric-corrosion tests on various steels indicates that the 3½%-nickel steel is one of the best, showing a considerable increase in life over plain carbon steels. Because of the higher yield point without loss in ductility or resistance to impact, they have become popular for structural fabrication. A few such uses are railroad-car construction, truck gasoline tanks, auto-truck bodies, excavating machinery, pressure vessels, coal-mining machinery, dredges and hoisting machinery.

The physical properties of this steel indicates its suitability for all purposes where strength, durability and resistance to shocks are required. Plates of S.A.E. 2335 are generally stocked today by the leading steel jobbers and warehouses. It is hot rolled and annealed. The carbon content will average 0.37%, and nickel will average 3½%. The physical properties of this steel are as follows:

Tensile strength	85,000 lb. per sq. in. min.
Yield point	50,000 lb. per sq. in. min.
Elongation in 2 in.	18%
Brinell hardness	212

Air-Hardening Properties Present Welding Difficulties

The cutting, shearing, punching or burning of this steel has presented very little difficulty to the shops, but certain problems have arisen insofar as the welding is concerned. This material has air-hardening properties due to the carbon content and the presence of nickel, and hence it presents certain difficulties in welding.

The welding of nickel steel can be divided into the following three divisions:

(1) The welding of 3½%-nickel plates up to and including ¼ in. in thickness.

(2) The welding of 3½%-nickel plates over ¼ in. in thickness.

(3) The welding of nickel steels containing over 3½% nickel.

Whenever a new alloy is placed on the market it seems inevitable that the first attempts to weld it should be done with an electrode that will have a weld deposit similar in analysis to that of the parent metal. This is exactly what was done in the case of 3½%-nickel steel. A commercial shielded-arc coating of the so-called carbonaceous or organic type that gave very satisfactory results on a mild-steel wire was extruded upon a wire having an analysis corresponding to S.A.E. 2335. Upon butt welding 3½%-nickel plates, ¼ in. in thickness, that were securely clamped in position, it was found that a crack in the weld metal followed a few inches behind the arc for the entire length of the seam. This was attributed to the high carbon in the welding wire, so a wire containing 0.15% carbon was next tried, with the same sad results. A 2%-nickel steel electrode with 0.05% carbon was next experimented with and better results were obtained, although hair-line cracks in the weld metal were observed under the microscope. Since the time of these experiments satisfactory shielded-arc electrodes with a mineral or inorganic type of coating have been produced with a 2%-nickel-steel core, but they are good for flat-position welding only.

Nickel and Carbon Pick-Up Is Desired

From the preceding experiments it soon became evident that 3½%-nickel plates could not be welded satisfactorily with an electrode of the same analysis or even with an electrode having greatly reduced nickel and carbon contents. Tests were next made with a shielded-arc mild-steel electrode, used with reversed polarity, and very satisfactory results were obtained. Welds made with this electrode on 3½%-nickel plates of ¼ in. maximum thickness developed a tensile strength of approximately 95,000 lb. per sq. in. This high strength, as compared to the normal 65,000 to 75,000 lb. per sq. in. for this electrode, was traced directly to the nickel and carbon pick-up from the plate. A chemical analysis of the weld deposit showed 2% to 2½% nickel and 0.14% to 0.18% carbon, depending upon the diameter of the electrode and the welding current. A 5/32-in.-diameter electrode is recommended for ¼-in. and 3/16-in. plates. The ¼-in. plate should have a 40° bevel for best results.

A type of electrode that is enjoying increasing popularity for structural and general shop welding is the straight-polarity shielded-arc electrode. This electrode develops considerable higher tensile strength and yield point with correspondingly lower ductility. Comparisons of the physical properties of straight-polarity and reversed-polarity electrodes are as follows:

	Straight Polarity	Reversed Polarity
Tensile strength	70,000 to 80,000 lb. per sq. in.	65,000 to 75,000 lb. per sq. in.
Yield point	58,000 to 63,000 lb. per sq. in.	47,000 to 55,000 lb. per sq. in.
Elongation in 2 in.	20% to 28%	20% to 35%

In view of the higher physical properties shown, the straight-polarity electrode may appear to be the better choice for welding nickel steel, but there is one very serious drawback of this electrode—namely, small penetration. The straight-polarity electrode has approximately one-half the penetration developed by the reversed-polarity electrode. Naturally, the absorption of nickel and carbon will be less; and even though we start with higher tensile strength and yield point with the straight-polarity electrode, physical properties more closely simulating those of the nickel plate will be developed with the reversed-polarity electrode. Certainly this is true in regard to butt welds, although there may be instances were the straight-polarity electrode is acceptable for fillet and lap-welds due to its ease of operation, especially on thin plates.

A 5/32-in.-diameter electrode is recommended because the heat of welding produces a greater effect on the parent metal in a zone adjacent to the weld in nickel steel than when welding ordinary mild steel. This is due to the higher carbon content and the presence of

nickel. A small-diameter electrode will cause less thermal disturbance of the parent metal. This is especially true on thin plates, where single-pass welding is used. On heavier plates where two or three passes are required, a larger-diameter electrode may be used if the layers of weld metal are applied rapidly to heat up the section adjacent to the weld and prevent quick chilling. Preheating the plate to a low temperature will prevent this chilling effect on any thickness of plate and give increased ductility to the weld metal.

We also obtained some very interesting data in regard to the welding of heavy 3½%-nickel plates. One-inch-thick plates were beveled at 30° and butted together so that the included angle of the joint was 60°. A ¼-in.- diameter mild-steel shielded-arc electrode was used to make the weld, and 0.505-in.-diameter tensile-strength specimens were taken from the center of the weld in such a manner that they represented all weld metal. The physical properties of these test pieces averaged as follows:

Tensile strength	78,650 lb. per sq. in.
Yield point	72,380 lb. per sq. in.
Elongation in 2 in.	15%
Reduction of area	27%

These test bars analyzed: carbon 0.10%, and nickel 0.83%.

It is evident that the ratio of the volume of plate metal melted to the volume of metal deposited is less in this type of joint than in the butt weld on 3/16-in. and ¼-in. plate previously mentioned, where the weld analyzed over 2% nickel and over 0.14% carbon.

Thick Plates Should Have Double-V Butt Joints

It is an interesting fact that in the 1-in.-plate butt weld, the nickel content averaged 2% at the bottom of the vee and 0.75% at the top of the joint. A more satisfactory job would have been obtained if a double-V joint had been used; in fact, a double-V joint is recommended on all plates over ¼ to ⅜ in. in thickness wherever possible, so as to increase the nickel and carbon pick-up.

Where the type of joint employed on heavy plates is not conducive to nickel or carbon pick-up, a shielded-arc electrode containing 2% to 2½% nickel with low carbon content is recommended.

Although there is very little occasion to weld nickel steel containing over 3½% nickel, it should be mentioned that higher nickel content presents greater difficulty in welding. A very popular steel of this type is S.A.E. 2512, containing 5% nickel. This steel is used principally for small parts such as transmission gears, ring gears, rock-drill parts, and a variety of machinery parts for heavy-duty service.

This 5%-nickel steel can be welded satisfactorily if preheated to approximately 700° F. and a 2%-to-2½%-nickel electrode is used. A thorough heat-treatment should follow. In making a temporary repair job until a new part can be obtained, do not preheat, but use a stainless-steel electrode of the 18-8 type. Do not use a diameter larger than 5/32 in., but preferably ⅛ in. Run in stringer beads; do not weave. Allow each pass to cool to at least hand warmth before applying each succeeding layer.

Reversed-Polarity Steel Electrode Should Be Used

Hence, in welding 3½%-nickel plates, the following points should be kept in mind:

(1) For plates ¼ in. in thickness or less, it is recommended that a mild-steel shielded-arc electrode suitable for Class 1 work on carbon steel, of the reversed polarity type, be used. The electrode diameter should not be over 5/32 in.

(2) Plates ⅜ and ½ in. thick may also be welded with this electrode, depending upon the type of joint used.

(3) For plate thickness over ¼ in., where high impact values are required, especially at low temperatures, a shielded-arc electrode containing 2% to 2½% nickel should be used.

Charles L. Bastian, Blind Manufacturer, Dies

Though handicapped with total loss of sight at the age of 45, Charles L. Bastian, an organizer of The Bastian-Blessing Co., and the company's first president, became a powerful influence in the compressed-gas and welding fields. His death on Dec. 4 recalls to mind that his success was made while handicapped with blindness, and serves as an inspiration to others.

Mr. Bastian was born in Germany in 1861, coming to this country at the age of 19. After a brief time working on a farm, he joined the T. S. Wild Manufacturing Co., where he discovered his aptitude for mechanical appliances, and later purchased an interest in the company.

In 1891 he organized the Charles L. Bastian Manufacturing Co., at which time he designed his first cylinder valve, which was exhibited at the World's Fair in Chicago in 1893. Later he invented and developed a large number of mechanical appliances for high-pressure gases, among them the diaphragm regulator.

In 1907, as a result of nervousness and overwork, Mr. Bastian lost his eyesight completely and never regained it. Despite this handicap, the following year he and others associated with him organized The Bastian-Blessing Co., capitalized at $50,000. Though he retired from active participation in the affairs of this company in 1928, owing to ill health, nevertheless, he held the position of chairman of the board at the time of his death.

In the early days of oxyacetylene industry in this country, Mr. Bastian was quick to appreciate the possibilities of the process, and he designed regulators suitable for oxygen, hydrogen and acetylene. He held many patents on regulators, cylinder valves, etc., and designed a great deal of automatic machinery for use with gas.

In his active years, he was in his office every day and kept in close touch with every department of the company. He had a remarkably retentive memory. He was constantly designing and improving mechanical equipment, and all products of the company were examined and approved by him before being put into production, though such examination had to be done without sight.

Although unable to get about and meet the trade, Mr. Bastian had a wide acquaintance in the welding and cutting industry.

Recovers Pipe Tap From Tank by Ingenious Method

When a ½-in. pipe tap, about 2 in. long, was accidentally dropped into an ammonia receiver, there remained only one way to remove it without cutting the vessel apart, and that was to bring it out through a nipple in the tank. The receiver itself was about 30 in. long and 6 in. in diameter, and the nipple was only slightly larger than the diameter of the tap, so it had to be removed end first. The problem was put up to E. A. Johnson, a welder with the Bell & Thorn Machine Co., 3426 S. Wabash Ave., Chicago, Ill., who, by employing an ingenious method, recovered the tap in 3½ minutes.

Johnson turned the receiver so the nipple was on the bottom, then, working through one of the holes in the tank, he moved the tap so its edge hung over the end of the nipple. Then, with the receiver set up so he could drawl under it, he lay on his back under the vessel and, gripping an electrode holder with an electrode in its jaws, he put the end of the electrode into the nipple, carefully moving it toward the end of the tap. When the electrode was within about ⅛ in. of the tap, he quickly touch it to the tap, at the same time signalling to his helper to shut off the welding machine. With the electrode stuck to the tap, Johnson easily manipulated it so he could draw the tap through the nipple. The flame from an oxyacetylene torch, the head of which was stuck into the tank through one of the small holes, provided sufficient light on the inside of the tank while the tap was being recovered.

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Why Should Piping Contractors Recommend Welding to Architects and Engineers? . .

Paper read at the 37th Annual Convention, International Acetylene Association, St. Louis, Nov. 18-20, 1936.

By SHERMAN T. SEELEY
Midwest Piping & Supply Co.

FROM man's first conception of moving liquids under pressure from one point to another, trouble was experienced in joining one end of a section of the carrier to another. Water lines were constructed in 1652 by our forefathers in Boston, using bored-out logs as their means of transportation. Joints were made by inserting a reduced section into the other member, greatly resembling the bell-and-spigot joint of today. Wooden pegs were used to more securely fasten and strengthen this primitive joint. Sections of these old log water mains have been removed during excavation in some of our older city streets; and while the body of the log proper could have been retained in service for a great many years in addition to the life of its actual service, definite failure of the joints was in evidence and probably had rendered the line unserviceable.

First Pipeline Made With Discarded Rifle Barrels

With the introduction of iron, the first pipeline of record was constructed, employing the use of discarded rifle barrels with a reduced-section of one end screwed into the end of its abutting rifle barrel. This practice of threading and tapping, with variations, became the commonly used method of joining one tubular section to the other.

In 1824, with the introduction of commercial tubular sections, now known as pipe, the standard tapered pipe thread and the female coupling were brought about.

For the purpose of changing direction of flow and for running branch lines, a line of pipe fittings was developed and brought into common use. With the advent of higher pressure and temperatures, with their consequent increasing stresses and strains, the flanged joint was developed with its accompanying flanged fittings.

The use of flanges went through the stages of a ring flange screwed onto the end of the pipe, the riveted flanged connection, the expanded or peened joint, and finally the flared-over pipe-end with its loose ring flange, now known as the lap joint, or Van Stone. Modern fabricating shops have developed the Van Stone joint successively through (1) a process of machine flaring of the pipe by rolling, with its consequent reduction in wall thickness caused by the stretching action, (2) the square corner and large fillet lap with full pipe wall thickness after machining, and (3) a process whereby the upset portion is materially increased in thickness over that of the original pipe wall. With the perfection of this joint, which depends entirely upon compression and friction for its tightness, it is believed the utmost in efficiency has been reached.

Thus it is seen that the problem of the engineer and manufacturer has always been the joining of the sections of a pipeline so that it would perform the work intended.

In the construction of articles made of wood, the joint has always been the first part to fail. Had we been in possession of a method for joining wood sections to produce a cross-section equal to the strength of the original wood, we would still be using wood in place of many articles now made of metal.

We now have a method of joining two or more parts of metal whereby a section is produced that, to all intents and purposes, is equal to and in many cases superior in strength to that of the parent metal. It should be borne in mind that once two metals have been heated to a fusion temperature and a perfect bond made between them, we do not have a joint but a homogeneous mass.

The ideal piping system would be one of equal strength and solidity throughout its runs, with no troublesome weak links.

Ideal Pipeline Possible Only When Welded Throughout

The nearest approach to this ideal is a system joined continuously insofar as is practicable, employing the art of welding. Each of the commonly used welding processes has its merits and its place in the industry, and each should be used where the best results can be obtained by that particular method.

Before getting into the fundamentals of this discussion, we must define the general interpretation of the duties of the professional engineer and architect. Generally, the engineer confines his professional activities to the design of steam and electric generating plants and industrial plants, many of which require the installation of high-pressure, high-temperature piping as well as low-pressure installations for processing services. The architect usually confines his professional activities to the design and supervision of the construction of monumental and commercial structures, requiring only the installation of piping systems for heating, air conditioning, distribution of hot water, and general process lines required in such structures. However, a properly installed piping system, constructed by experienced craftsmen possessing a thorough knowledge of their industry and in accordance with well-prepared specifications, covering a design embodying the most improved methods and materials, should be of prime interest to both the engineer and the architect.

The evolution of piping design, fabrication and construction has gone forward with great strides in recent years, as have the design, construction and efficiency in operation of the prime movers and auxiliaries which it serves. Only in recent years—with the advent of extremely high pressures and temperatures in the case of the engineer's central generating station, or the complicated designs ventured by the architect in connection with his profession—has either the engineer or the architect given the piping installation the same amount of necessary study during the period of design or construction, that he has always been accustomed to giving the prime movers of a mechanical system and the sub- and superstructure of the building housing this system of arteries carrying the vital elements that make the wheels go 'round.

However, those firms and individuals engaged in the important task of manu-

facturing the raw materials, or fabricating these raw and semi-finished materials, as well as the contractor making the installation of high- and low-pressure piping systems, have kept astride of the demands of these newly-created and severe operating conditions. I can go so far as to say that we of the piping industry, in the creation of permanent standards of materials, our research activities, and our shop or manufacturing facilities, have anticipated conditions of even greater severity than are at hand at the moment. Engineers and architects engaged in the most modern designs have also kept well informed of the advancement of our industry and have availed themselves, speaking generally, of the facility and knowledge we possess.

For the engineer who confines his duties generally to central steam and electric-generating plants and those of the large industrial projects, it will be necessary in this discussion to treat of the design and ultimate installation of pipe work separate from the requirements of the architect's design, although much to be said with direct reference to the engineer will also apply to the architect and warrants his attention.

The engineer designing modern power plants is confronted with the serious problem of transporting the elements from their source to points of service, reclaiming both steam and water after the prime service has been accomplished, in his effort to maintain balanced efficiency. The architect's principal worry, after completing his efficiency studies and prior to the starting of his piping design, is space limitation and appearance.

Pipelines Deserve as Careful Consideration as Other Equipment

In the design of a piping system for the central station, many engineers are realizing more and more the importance of treating their piping problems with the same infinite consideration and caution as they do the selection of and the study always given the prime movers and their respective auxiliaries, weighing carefully and cautiously these obviously essential features: efficiency in operation, permanency of materials, flexibility of design and fabrication, cost of maintenance, anticipated extensions, and last but not least, initial cost.

Generally, the piping system comprises fabricated piping, valves, fittings, jointing materials, automatic and manually operated steam specialties and insulation, each commodity being represented in the industry by well-organized concerns having at their command highly trained and efficient engineers skillfully adapted to their respective duty. So, as a representative of the fabricated-piping and piping-contracting industry, I shall confine my remarks to those concerning fabricated piping, specification of materials, their relative costs and piping design generally, making no reference to the design and efficiency of valves or steam specialties and insulation.

The Modern Piping System Can Be Made Practically Jointless

The ideal piping system would be that of an absolutely jointless job and with the advent of the welding fitting for most any conceivable use, and the welded valve, this acme of perfection has just about been reached. In the days of the flanged- or screwed-fitting job, the designing engineer was compelled to base his design on those fittings and joints as had become standards in the industry. Full and sufficient information could be obtained from catalogs or handbooks close at hand; furthermore, he was compelled to resort to the use of three weights of pipe in most popular sizes—namely, standard, extra heavy and double extra heavy.

With the increasing demand for a greater variation of pipe weights and for stronger materials, seamless tubing has become a universal standard where abnormal pressures and temperatures are encountered. It is now practicable to select tubing of the proper wall thickness to serve efficiently in the duty it is to perform. With these new standards of tubing, wall thicknesses are calculated closely to factor-of-safety requirements for the respective recommended services, and the engineer can design the piping system with greater accuracy, obtain a high degree of flexibility, and at the same time materially reduce the dead weight of the pipe work and its accompanying strain on the equipment to which it connects. The increased cost of seamless tubing as compared with welded pipe is negligible.

Flexibility—the control of expansion and contraction caused by the internal and external stresses of a piping system—is of prime importance. While the location of anchors and other supporting and hanging members can be fairly well calculated, one is never sure and can only wait for results after the lines have been placed in operation. But the elimination of the flanged fitting and flanged joint, these being replaced with welded outlets, welded girth connections, pipe bends, and welding fittings, has practically eliminated the hazard of leaky joints and casting failures with resulting plant shut-downs and loss of plant production and often life.

Comparisons of the cast fitting with the welding fitting are of great interest. For instance, in the final determination of the wall thickness of cast steel fittings, 50% is added to offset the variation of hoop stress in the cross-section of the wall, depending on the curvature of the fitting. It should be explained that this substantial addition to the computed wall thickness is to compensate for the possible variations in wall thickness caused by shifts and surface facings of molds and cores and is necessary because the fittings, in which a portion of the metal in the wall is removed in order to provide the branch connections, are not as strong as a straight, continuous cylinder. Crosses are weaker than tees, and laterals are weaker still, because the original cylinder wall is progressively weakened in all these various types.

It is not at all surprising that laboratory destruction tests on cast-iron and cast-steel elbows show that rupture occurs at the crotch, since, when these tests are made, the ends of the fittings are closed and all the stresses are focused at the crotch. However, there is no similarity between this laboratory test and the actual field test, as in all my experience I do not know of one instance where a perfect casting has ruptured in the crotch; but where rupture has occurred, it has always been at or near the juncture of the flange and the casting body.

With the installation of welding ells, welded into the lines in lieu of cast fittings, the hazards of all crotch and fillet failures have been completely eliminated, and a continuity of wall thickness and tensile strength obtained.

Shop Welding Has Advantages Over Welding in the Field

With the engineer fully desirous of keeping the number of flanged joints and flanged cast fittings reduced to the very minimum in piping design, and with the specification well defined concerning the use of welded joints and connections, he is now confronted with the problem of when to employ shop welding and when field welding. Obviously, the better the facility to execute an operation, the better the job and the greater the production attained at reduced costs. Hence, as much of the welding on a fabricated assembly should be accomplished in the shop as is practicable, and the field welding minimized to the fullest extent. The extent of the shop welding is limited only to the size and shape of the completed piece; the over-all dimensions being restricted only by shipping limitations or cramped handling facilities at the site of erection.

The advantages of shop welding over field welding are numerous. The modern-equipped shop has every labor-saving device, such as overhead traveling cranes, lay-out tables, straightening tables, and rotating machines capable of handling work of any size, weight or shape, thereby permitting the mechanic to confine his welding to a natural position, the work turning at a speed under control

of the workman, who at no time is compelled to assume an unnatural position in the execution of the weld. Testing tables and stress-relieving furnaces are also provided, and every convenience for rigid inspection is at hand. In the field, however, none of these facilities are provided, and as a result the speed of the mechanic is greatly impeded, and the cost of production greatly increased.

In order that the engineer or architect may avail himself of the advantages and savings to be effected in the shop-fabricated "ready-to-erect" job, he must have a broad knowledge of just how far our facilities and experience permit us to go. In designing his fabricated pieces or systems as a whole, he must take into consideration that when the minimum has been reached for the radius on which to bend a particular piece of pipe, a welding ell must replace the bend; that welded outlets, with or without reinforcement, can replace any standard branch fitting; that the center-to-face measurements of a welded outlet can even be less than that of the outlet of the fitting standard which it has replaced; that elbows, straight or base type, can be made up from welding ells and welded-on flanges; and that the use of flanges, except when abutting to a valve, equipment or other specialties, is absolutely unnecessary, their presence only working a hardship on the owner in the maintenance of the joint and its initial cost.

Welded Piping System Shows Great Savings in Costs

In addition to the advantages to be gained in the flexibility, decreased dead weight, minimum friction loss, complete tightness and general well-engineered appearance of the welded-up piping system, saving in costs of the finished work is in evidence to a surprising degree. For example, consider an 8x6-in. flanged tee in a steam or water line, this tee having its two abutting flanges in the run, together with the gaskets and connecting studs or bolts. Now with this picture in mind, cut the tee out entirely, replace the outlet with a welded flanged nozzle and throw the connecting-run flanges along with the gaskets and studs or bolts into the discard—and you have the true picture of the saving in the completed welded connection versus the flanged job:

	CAST STEEL				CAST IRON	
	Ser. 90	Ser. 60	Ser. 30	Ser. 15	Ex. Heavy	Standard
Flgd. Fitting Assembly	$360.74	$171.59	$85.73	$65.90	$49.13	$28.14
Welded Assembly	85.03	42.76	25.14	22.67	27.65	16.98
Saving	275.71	128.83	60.59	43.23	21.48	11.16
Saving in per cent	76%	75%	70%	65%	44%	40%

In these cost comparisons, all outlet welds were computed on the basis of straight fillet welds with no reinforcing member. From the standpoint of strength or safety of the weld using reinforcing straps, there is little to be said in its favor. The strength apparently added by these straps may be an illusion. They do, however, add considerable expense and partly cancel certain great advantages of welding, such as smoothness, good appearance and ease of insulation.

On the strength basis, alone, the objection to straps or gussets is that they tend to set up stresses because of differential expansion and contraction in the welding process. Similar strains may be set up when steam is admitted or shut off from the line. Much of the trouble experienced with flanges and flange bolts or studs on high-temperature steam lines is caused by heavy projecting masses of metal that lag in temperature when the pipe is rapidly heated and cooled.

Remember, first, that pipe and tubing have a high factor of safety against lengthwise rupture; second, that the factor against circumferential rupture is twice as great; third, that a weld made by a properly tested welder under proper procedure control will show the full strength or even greater strength than that of the base metal.

Going back to our former example, let us consider the cumbersome flanged 8-in. elbow in the line, with its accompanying pair of flanges, its gaskets and studs or bolts. We will replace it with a long-sweep, truly-uniform-wall-thickness, stress-relieved welding ell, with its tangent on either end facilitating the setting-up and squaring-up process, and of course, the two butt welds required to put it in the line. Here are the cost comparisons of these two designs:

	CAST STEEL				CAST IRON	
	Ser. 90	Ser. 60	Ser. 30	Ser. 15	Ex. Heavy	Standard
Flgd. Fitting Assembly	$259.01	$126.72	$68.01	$51.21	$42.35	$28.14
Weld. Ell Assembly	48.93	38.25	27.96	26.75	26.75	26.75
Saving	210.08	88.47	40.05	24.46	15.60	1.39
Saving in per cent	81%	70%	59%	47%	37%	5%

All the above figures are based on the average good specification and are accurate in every detail. The unit material and welding costs used in their preparation are those being generally used by the well-equipped shop.

The cost of making a 90° bond in long lengths of pipe in lieu of the welded ell assembly shows even a further saving, running from 50% downward, based on the cost figures given here.

Another important factor in the selection of a shop-fabricated welded job and its "ready to turn" cost is that of field erection. Obviously a cast-flanged job of innumerable pieces and sections has to be placed into permanent position a piece at a time, or assembled on the floor before erection, thus requiring considerable extra time; every face has to be thoroughly scraped and cleaned, every joint squared up, the gasket carefully placed, and the jointing studs or bolts securely pulled up—all this, as compared with handling and raising into position a single piece or welded assembly. The labor saving of the latter is tremendous, but of course impossible to accurately compute owing to the greatly varied field conditions and labor wage scale. It cannot be denied that castings are porous; they very often develop serious blow-hole leaks and often completely fail while in service; nor can it be denied that a flanged joint of any type or design is not fool-proof to the extent that it will remain absolutely tight during its life. It can be proved conclusively, however, that a weld, when properly made, inspected, and tested by reliable hands, is one homogeneous mass, equally as strong or stronger than the parent metals.

Flanged and Screwed Joints Have Not Been Completely Eliminated

Notwithstanding the tremendous advantages and savings in costs and maintenance of the welded assembly, the complete elimination of the flanged or screwed joint has not as yet been accomplished and probably never will be.

There are a great many types and designs of flanged joints for all known pressures and temperatures, and there is much to be said of the types in general use, particularly those for service under the more severe conditions. Every joint of proven merit, however, has its particular service or condition where it will excel. For extremely high pressures and temperatures, the reinforced square-corner Van Stone joint, the butt-welding-type flange, or the hammer-welded flange with its standard raised face or equipped with male or female faces, seem to be the most serviceable.

Also, the narrow tongue-and-groove facing has great merit with its very limited gasket-bearing surface. This narrow tongue or groove can be readily machined to a fine tool finish in the forged butt-welding flange, and some of the better-equipped fabricating plants can produce a lap or Van Stone joint of sufficient thickness in the rough to permit the machining of this type of face without rendering the finished lap unsafe, and at the same time provide the facility of handling and erection in the loose swivel flange.

The completed butt-welding flange places its butt weld in tension, whereas on the other popular type of welding flange known to the trade as the "slip-on and welded type" the welds are placed in shear. These slip-on flanges, however, are entirely satisfactory for the services

permitted by the codes, if not desirable from the standpoint of cost and ease of application. The butt-welding type is entirely practical for the higher pressures.

Because of the numerous types of flanged joints and the varying conditions and services for which they are best fitted, I will not attempt to make recommendations, but will give you accurately computed cost comparisons, making only two divisions—namely, high pressure (above 150 lb. per sq. in.), and low pressure (not in excess of 150 lb.):

HIGH PRESSURE

1: Ser. 60 forged-steel reinforced Van Stone flange with male and female laps or narrow tongue-and-groove facing	100%
2: Ser. 60 forged-steel butt-welding flange with male and female or narrow tongue-and-groove facing	67%
3: Ser. 60 forged-steel butt-welding flange with ¼-in. raised face	63%
4: Ser. 60 forged-steel reinforced Van Stone flange	56%

NOTE: For Ser. 30 there is practically no difference in the cost of Nos. 3 and 4.

LOW PRESSURE

1: Ser. 15 forged-steel reinforced Van Stone flange	100%
2: Ser. 15 forged-steel butt-welding flange	93%
3: Ser. 15 forged-steel slip-on welding flange, welded front and back	91%
4: Ser. 15 forged-steel screwed flange, screwed on tight by power and back welded	76%
5: Ser. 15 forged-steel screwed flange, screwed on tight by power and refaced	60%

The high-pressure comparisons are based on the cost of Series 60 flanges made up ready for erection, these being suitable for a recommended pressure not in excess of 600 lb. for high-pressure standards. Above and below the series used, however, the cost comparison is relatively the same. As the standard of excellence (100% price value) the most expensive type of joint regularly specified is employed. The pipe size used in this schedule is 8 in. All units given include the cost of the finished steel flange, together with the cost of making it up on the pipe end ready for use.

Of the innumerable types and designs of flanged joints, one in particular, now in service and continually being used for a great many large and successfully operating projects where pressures and temperatures are excessive, is similar in design to the Van Stone joint with a cold-water machine-finished face. This joint is made up without a gasket and is tested when completely erected by means of hydraulic pressure equal to 200% of the intended hot working pressure. This hydraulic test is principally intended to check the squareness to which the faces have been made up. Upon completion of this water test and with all joints drop-tight, the studs are removed one by one and the specially prepared machined lips on the outer edge of the pipe laps are seal welded, the welding operation progressing slowly around the periphery of the lap lips. The studs are then replaced and made up tight immediately behind the welder. This joint is leak-proof.

Then there is another type of gasketless joint, resembling to a great degree, at the contact faces, the principle of the ground joint union. This joint is now in operation in a great many notable installations and is in extensive operation in oil-refinery installations where high pressures and temperatures are prevalent.

While the contents of this paper, thus far, may appear to have been directed primarily to the engineer concerned with high-pressure work, the expressions generally concerning the importance of a bottle-tight, flexible job, and the practices employed by the piping fabricator and contractor who is equipped to execute the proper sort of a welded piping system, also apply to the design and installation which is the responsibility of the architect.

As previously mentioned, one of the architect's principal worries in the stage of piping design is the matter of space limitation. Considerate architects favored the mechanical trades in providing sufficient space in basement, attic and pipe-shaft areas for workmen to conveniently swing their materials, wield large chain tongs and other cumbersome tools of erection, and in so doing they denied their clients considerable area that could have been finished for occupancy or other paying uses.

Welding Simplifies Problems of Design

While sufficient space must be provided for the mechanic at points of the welds in a piping system confined to the close quarters of the modern building, the architect can now proceed with the design of a welded piping job, disregarding the requirements of the steam fitter and his clumsy tools of erection; he can dispense with the facility usually provided in access doors and panels for entering the concealed spaces to repair leaky threaded or flanged joints; and, what is more, he can completely discard the necessity of designing his piping around a few standard screwed or flanged fittings.

With the employment of welding fittings and a completely welded job, he can proceed, with the ease of design permitted by the practical and safe methods used in welded construction. He can further anticipate a minimum quantity of strictly position welds, in the knowledge that a greater portion of the welded assemblies are made up to measurement immediately under the point of erection; the welder with his torch and with very little assistance goes about his work as skillfully and with no more effort than does the carpenter with his hatchet and saw. Hideous-appearing screwed or flanged main pipelines installed in the basement or attic space of a building purposely left exposed for the convenience of making repairs, are being replaced in the most modern buildings and institutions by welded construction, then permanently concealed behind plastered ceilings or walls, and the space used with the same dignity as exists elsewhere in the building.

With the use of welding ells, pipe bends and welded branch connections, flexibility of the runs has increased in unbelievable measure, and the necessity of closely calculating the location and design of anchors for the proper distribution of expansion and contraction is not required. There are no cast fittings to snap at critical points, no threads to break due to offset or their being cut "drunk," nor are there the ever-appearing leaks due to faulty pipe threads or defective fittings, all with their resultant property damage and shut-down, resulting from the terrific strains thrown on the system with its intermittent load demands. With the welded system, expansion and contraction should be controlled for as accurately as possible, but the extent of such control has been greatly reduced; and should the engineer or contractor miscalculate the action of his pipe stretch when hot, the lines will usually take care of themselves, working no hardship on the system or causing any damage.

The welding of low-pressure piping in buildings has its economical limits, however, and the risers, radiators, runouts, drips, etc., usually of small diameter, are installed with screwed fittings. The possibility of leaks in these smaller sizes, however, is quite remote owing to the reduced total area engaged in the thread and tap of the joints, and the fact that it takes less man strength to make them up.

With welded-main construction, risers and branch lines can be run without regard to the main location, as can the main be run without regard to its branches. Branches can be run in advance of the installation of the main and later connected without the use of a union. This up-to-date method and procedure of main-and-riser installation is a medium of labor saving in no small degree. The final connection between branch, riser and main is not always made using stock nipples brought to the main with a plain end for final welding at the convenience of the welder, and cuts are rarely required as would always be the case where the final connecting pieces are required to join at a predetermined point in the main.

It was my good fortune to have charge of the heating, air conditioning and other mechanical systems in some of the principal Federal buildings in Washington constructed in the past seven years, the first being the new Department of Commerce Building, by far the largest Federal building constructed to date. Welded boiler-room and main-run welding construction was employed throughout its heating system, although the design and specifications were prepared around screwed and flanged fittings. Representatives of the architect and the Government, when approached concerning welding on this particular job, ac-

cepted the recommendation without hesitancy. Time studies and material-cost comparisons were made throughout the life of this contract and records kept by me at that time were amazingly in favor of welding as compared with screwed or flanged construction; and because of the results obtained in the economy of installation, operation and maintenance, the general good appearance, and with conclusive proof that the work was installed cheaper than the job as originally designed, the U. S. Treasury Department opened the specification with practically no limits concerning welding. Other Government departments were fast to fall in line based on this decision.

Other welded heating and air-conditioning jobs on which I made similar cost comparisons, were the new Post Office Department Building, the old Department of the Interior Building, the new Woodrow Wilson High School, the Terrace, Fountain and Senate Garage in the U. S. Capitol Plaza, and the U. S. Botanical Gardens, all in Washington, also the new U. S. Customs house in Philadelphia.

I wish to qualify the Terrace, Fountain and Senate Garage installation by stating that while we were not permitted by the architect of the Capitol to make the welded installation in the heating runs, all the bronze castings originally designed to create the effect of the water sprays in the main fountain, were fabricated from copper pipe with brazed outlets and connecting flanges. The saving in this great quantity of fabricated brass piping as compared with the bronze-casting estimate was tremendous.

For the chilled-water and condensing-water piping always incorporated in the larger air-conditioning systems, prefabricated and field-welded construction has its outstanding merits. Here friction loss in the cycle of the water flow is a tremendous factor. The installation of sweeping pipe bends or welding fittings with welded outlets placed where most convenient and at such angles as to induce good flow, in lieu of the short-turn ells and tees causing abrupt change in the direction of the flow, is of great advantage. By the use of this welded construction, permitting ease in flow, pipe sizes can actually be reduced and a tremendous load taken off the pumping units.

Saving Is Made in Cost of Insulation

It has been shown that with all its advantages and merits the welded system costs considerably less, material and labor considered, but another most important economical phase entering into air conditioning chilled water installations that we do not have on other hot or cold lines, is that of the cost of cork insulation. Every tee, cross lateral or elbow requires a specially moulded cork fitting, as does every intermediate flanged joint. The cost of these special moulded cork fittings is ridiculously high as compared with that of straight cork pipe sections. With the installation of the welded outlet, straight section covering is used, merely cutting out at the time of application for the welded outlet. In the case of long sweeping pipe bends, straight pipe sections are also used, these being miter-cut as they go around the bend, making a neat appearance and costing only slightly more than that of straight sectional work. Welding ells of the long-turn type are treated in the same manner as the long-radius bend. In crowded quarters this space-saving device in the elimination of bulky flange and fitting covers is of great importance and there is no comparison in the general appearance of the job. This matter of cork covering deserves serious consideration and investigation by the architect.

Largest All-Welded Smoke Stack Erected at Peoria

What is thought to be the tallest all-welded steel smokestack was put in position at the factory of R. G. LeTourneau, Inc., Peoria, Ill., recently when this firm raised a tube 104 ft. long and 57 in. in diameter with an all-welded 84-ft. steel crane into place atop their heating plant.

Raising the Smoke Stack.

The LeTourneau company, which manufactures heavy grading equipment, welded the smokestack from ½-in. steel plates, the total weight being approximately 10 tons. The steel crane which raised it was also built by this same organization, and rides on six huge 18x24-in. tires. Lifting power is provided by a tractor, which also hauls the crane about.

The Welded Stack In Place.

The 84-ft. boom of the crane is reversible and has been designed so that it can be used for lifting a 40-ton all-welded steel house now under construction in the LeTourneau plant.

Purdue Holds Its Most Successful Conference

With more than 550 registered for the two-day event, the 12th annual welding conference held at Purdue University, Lafayette, Ind., on Dec. 10 and 11, made a new mark for registration and interest.

The exhibit space in the Michael Golden Shops was taxed to capacity by the 27 concerns exhibiting and demonstrating welding and cutting equipment and supplies, and allied materials.

One company displayed for the first time their new line of welding and cutting torches. Another demonstrated their process for flame-hardening gear teeth, and also the multi-layer welding of pipe. Another novel demonstration was the cutting of cast iron with the metallic arc. Another concern had on demonstration a new d.c. welder of the rectifier type. The cutting of intricate shapes with a mechanical torch was shown. The depositing of molten metal by spraying was also demonstrated. Aluminum was soldered with the torch at one of the booths.

There were also the usual demonstrations showing the welding and brazing of various metals by the arc and gas processes, and cutting of metals. On display were a wide variety of welding and cutting equipment and accessories, stainless-steel plates and castings, tools for sheet-metal shops, and many other articles.

Kansas and Iowa to Hold Conferences in March

March 18 and 19 are the dates set for the annual welding conference at Kansas University, Lawrence, Kan., while the annual conference at Iowa State College will be held at Ames, on March 24 to 26.

Standards for Welding Quality and Methods of Inspection of Fusion-Welded Power Piping

Paper read at the 37th Annual Convention, International Acetylene Association, St. Louis, Nov. 18-20, 1936. Slightly abridged.

By WM. D. HALSEY
Asst. Chief Engineer, Boiler Division, The Hartford Steam Boiler and Insurance Co.

IN RECENT years we have seen an increasing use of fusion welding in the fabrication of power plant piping, particularly for the higher pressures and temperatures that are coming into use. For numerous reasons such lines must be absolutely free from leakage and, because of troubles that have been experienced in the past with keeping mechanical joints tight, fusion welding has become a practical necessity for such service. However, in our enthusiasm for fusion-welded high-pressure lines, we must not overlook the possibility of a failure occurring which would cause untold damage to the welding industry and impose restrictions hard to overcome.

The company which I represent insures boilers, unfired pressure vessels, pipelines, engines, turbines and electrical machinery against damage resulting from certain kinds of failures as described in the policy of insurance. We make periodic inspections of the equipment which we insure to determine whether such equipment is in safe operating condition.

We are also extensively engaged in making shop inspections of boilers and pressure vessels constructed under the requirements of the A. S. M. E. Code which specifies that such boilers or pressure vessels be inspected during construction "by a state or municipal inspector of pressure vessels, or an inspector employed regularly by an insurance company which is authorized to do a boiler or pressure-vessel insurance business in the state in which the vessel is built, or in the state in which it is to be used, if known."

As a natural outgrowth of this shop inspection service we have been extensively engaged in the inspection of fusion-welded pipelines during construction.

Any equipment, the failure of which might cause personal injury or property damage, should be designed by competent persons, should be constructed by experienced fabricators or contractors, and should be inspected by an unbiased agency to determine, as far as practicable, that the requirements for safety have been met.

A high-pressure pipeline should be designed by consulting engineers or others who have had experience in such design. The proper thickness of pipe, the quality of pipe material, and the general layout with suitable provisions for expansion and contraction are the responsibility of those who design the pipeline.

It is the responsibility of the contractor who installs the line to meet the requirements of the designer and also to see that the quality of welding required is furnished.

As an insurance company making inspection of fusion-welded pipelines, we are interested primarily in safety, and it is apparent that the safety of a fusion-welded pipeline resolves itself almost wholly into a question of the physical properties of the fusion-welded joints.

"Class 1" Quality Should Not Be Specified for Pipelines

Considerable thought has been given to the quality of welding for high-pressure pipeline work. Many purchasers, having in mind the classification for fusion-welded pressure vessels adopted by the A. S. M. E. Code, have specified "Class 1" for the quality of the welding. The intent of the Code in referring to classes was primarily for a distinction in the degree of severity of service for a vessel rather than for the quality of the welding, although there was some difference in the requirements for weld quality.

In a fusion-welded pipeline, to completely meet the requirements of the A. S. M. E. Code for "Class 1," or what is now known as U-68, it would be necessary that every welded joint be examined by x-ray—a procedure that is impracticable, and in most cases impossible.

To meet the stress-relieving requirements for "Class 1" work every two sections of pipe that are connected would have to be placed in a stress-relieving furnace after the welded joint between the two sections had been completed. For every group of welded joints it would be necessary that a test weld be made for determination of tensile strength, ductility, and specific gravity.

When consideration is given to all the requirements of the A. S. M. E. Code for fusion-welded power boilers and U-68 vessels, it becomes apparent that they cannot be met, from a practical standpoint, nor are they applicable to fusion-welded pipeline construction.

The proper procedure for fusion-welded pipelines is to call for a specified technique of welding, an investigation of that technique of welding to determine that it will produce certain desired results, qualification of the welding operators under such procedure of welding, and an insistence that the procedure of welding be followed in actual construction. It is upon this principle that the requirements for welding in the A. S. A. Code for Pressure Piping are based, although certain recent developments have brought about some changes with respect to the method of qualifying welding operators, which the writer believes might well be incorporated in the A. S. A. Code.

Announces New Inspection Procedure

Within the near future our company will adopt a new inspection procedure for pipelines we are called upon to inspect. Our first requirement will be, as heretofore, that the fabricator or piping contractor adopt a specific procedure for welding and that he demonstrate to our representative that such procedure will produce welds having satisfactory tensile strength, ductility and soundness. The method to be followed to determine these facts is outlined in the "Tentative Rules for the Qualification of Welding Processes and Testing of Welding Operators" as published by the American Welding Society and which appeared in the October, 1936, issue of the *American Welding Society Journal*.

Our second requirement will be for

the fabricator or contractor to demonstrate to our representative that all welding operators can make sound welds when they follow the procedure of welding outlined and which has been investigated and found satisfactory. The procedure for the qualification of a welding operator is outlined also in the "Tentative Rules" referred to above.

The third requirement will be that a representative of our company make some visits of inspection during the fabrication of the pipeline for the purpose of determining that the procedure for welding is being followed. Particular attention will be paid to the materials being used, as such materials determine to a large degree the quality of weld metal that will be obtained.

It will be required that all welding operators be assigned an identifying number or symbol, and this number or symbol must be stamped adjacent to every weld which the operator makes. Upon the completion of the work the inspector will remove from the pipeline a complete welded joint, or a specimen from a joint, for each welding operator, and these welds or specimens will be examined for soundness.

As long as such examinations show that the individual operator is doing acceptable work by that process of welding, no requalification tests will be required. In other words, the individual operator must pass an initial examination to demonstrate his ability, and will be held fairly close to that quality of workmanship through the medium of a check on his work on the job. In some special cases some other method of inspection may be agreed upon by the owner or purchaser and the inspecting company.

The final step in the inspection will be, of course, the hydrostatic test.

Some points of the above procedure in the inspection of fusion welding on pipelines are worthy of further discussion.

Both the Process and the Operator Must Be Qualified

It is of particular interest to note that the American Welding Society's "Tentative Rules" recognize the principle that tensile strength and ductility in weld metal are determined by the procedure or technique of welding followed. This procedure or technique involves all the variables encountered. Consideration is given, not alone to the question of whether the gas or metallic-arc process is used, but also to the specific kind of welding wire used, to the shape of the welding groove, to the quality of flame used, to the number of beads deposited, and several other items. When it has been determined that a given procedure for welding will produce weld metal having a certain tensile strength and ductility, it is then useless to test every welding operator for tensile strength and ductility because those qualities are predictable under the given procedure. For the qualification of a welding operator under any given process, we desire to know not whether he can produce welds of a certain tensile strength and ductility, but rather whether he can make a *sound* weld by that process. By a sound weld we mean one that is properly fused, without excessive slag inclusions or porosity.

The "Tentative Rules" already referred to give suggested forms for the writing of specifications for different methods of welding, but I shall not attempt to discuss those suggested specifications, except to state that no specific instructions for welding are given. It is the duty of the person or persons having responsible charge of the welding to write the specifications setting forth in detail the method to be followed. No limitations are placed on the methods to be used, and there is entire freedom for the development of new ideas.

Method for Qualifying the Process

For the qualification of a process, it is necessary that welded pipe joints be made in those positions which are to be encountered in actual construction, and the welding of these joints must be done in accordance with the specifications. From each of these joints there are removed two reduced-section tensile specimens, two free-bend specimens for ductility, two root-break specimens, two side-break specimens, and two nick-break specimens. The specimens for the reduced-section tensile tests are prepared for testing as shown in Fig. 1. The specimens for the free bend are shown in Fig. 2, the root-break specimens in Fig. 3, the side-break specimens in Fig. 4, and the nick-break specimens in Fig. 5.

The methods for testing the tensile, free-bend and nick-break specimens have been in general use for several years and need no comment now. The method of testing the root-break specimens is shown in Fig. 6, and the side-break in Fig. 7. In the case of pipelines that are welded with backing strips or chill rings on the inside of the pipe, the specimens shown in Fig. 3 are polished on the sides and etched in a boiling solution of 50% hydrochloric acid and water. This method of testing is used instead of the root break to determine what penetration into the chill ring has been obtained.

The side-break test is somewhat new, and some research work done in connection therewith may be of interest. It had been felt that the nick-break specimen might not reveal any defects existing on the side walls of the welding groove. To investigate this matter a defective weld was made in which there was a slag streak of somewhat minor proportions on the side wall. The weld was x-rayed and it was found that the defect continued throughout the length of the weld. Four nick-break specimens were removed and three side-break specimens. Two of the nick-break specimens were broken in the customary manner with a quick, sharp blow, and the other two nick-break specimens were broken by a slow bending. All four of these specimens broke directly through from notch to notch as shown in Fig. 8. The side-break specimens broke through the side-wall defect as shown in Fig. 9.

Tests for Qualifying the Operator

In the qualification test for welding operators only the face-break, root-break, side-break, and nick-break specimens are used. The face-break test is made in the same manner as the free-bend test except that no measurement is made of ductility.

It is not to be expected that perfect welds will be demanded. There must be some tolerance and, therefore, there must be some method of evaluating lack of soundness. For this purpose, consideration must be given to what constitutes a defect. The rules define defects as follows: "Defects are defined as gas pockets, slag inclusions, and lack of fusion exceeding _____ in. in greatest dimension." The rules have not attempted to give any definite limit on the size of a defect as it has been felt that this value should be left to the discretion of those who adopt the rules.

The rules evaluate lack of soundness in the following manner: "Lack of soundness shall be evaluated by the total depth of all 'zones of defects,' measurement being made of such depths on a line or plane parallel to the throat of the weld. A 'zone of defect' is defined as the area within two lines perpendicular to the throat of the weld and bounding any one defect or any group of defects whose depths are overlapping." The rules give illustrations of typical cases of "zones of defects" (see Fig. 10).

The rules also contain the following statement: "The permissible total depths of all zones of defects on any plane parallel to the throat of the weld shall not exceed _____% of the specified weld-throat dimension in the case of fillet welds, or of the center of the two parts joined in the case of butt welds. The length of any permissible defect shall not exceed _____ times the plate thickness nor shall any two defects be closer together than _____ times the plate thickness." The rules have again left blank the values to be inserted by those adopting the rules.

Our company has adopted the following standards for welded joints in pipe lines:

Tensile Test. The reduced-section tensile-test specimen shall show an ultimate tensile strength not less than 90% of the

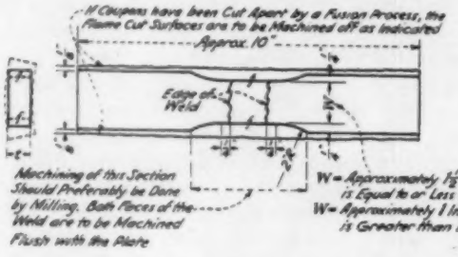

If Coupons have been Cut Apart by a Fusion Process, the Flame Cut Surfaces are to be Machined off as Indicated
Approx. 10"
Edge of Weld
Machining of this Section Should Preferably be Done by Milling. Both Faces of the Weld are to be Machined Flush with the Plate
W = Approximately 1½" where t is Equal to or Less than 1 In.
W = Approximately 1 In. where t is Greater than 1 In.

Fig. 1. Reduced-Section Tensile-Test Specimen for Pipe.

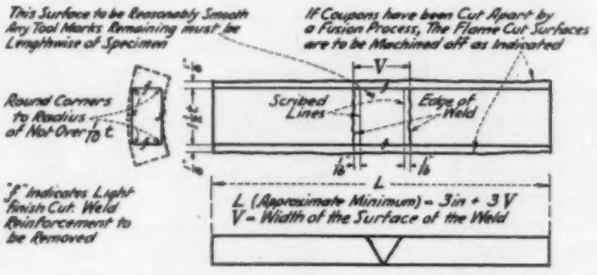

This Surface to be Reasonably Smooth Any Tool Marks Remaining must be Lengthwise of Specimen
If Coupons have been Cut Apart by a Fusion Process, The Flame Cut Surfaces are to be Machined off as Indicated
Round Corners to Radius of Not Over 1/10 t
Scribed Lines
Edge of Weld
"f" Indicates Light finish Cut. Weld Reinforcement to be Removed
L (Approximate Minimum) = 3in + 3V
V = Width of the Surface of the Weld
The Length of The Bend Specimen is Immaterial provided the Bend occurs at the Weld The Minimum Length indicated is only Suggestive and is Not Mandatory

Fig. 2. Free-Bend-Test Specimen for Pipe.

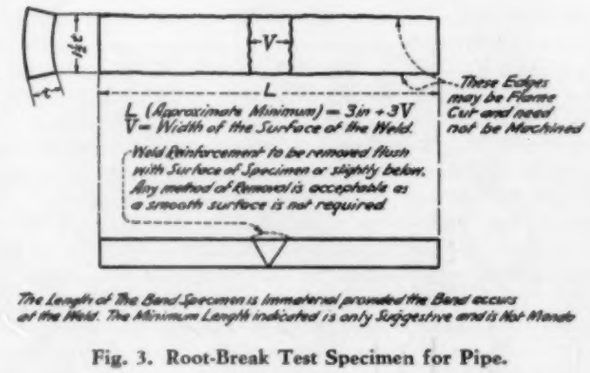

L (Approximate Minimum) = 3in + 3V
V = Width of the Surface of the Weld.
These Edges may be Flame Cut and need not be Machined
Weld Reinforcement to be removed flush with Surface of Specimen or slightly below. Any method of Removal is acceptable as a smooth surface is not required
The Length of The Bend Specimen is Immaterial provided the Bend occurs at the Weld. The Minimum Length indicated is only Suggestive and is Not Mandatory

Fig. 3. Root-Break Test Specimen for Pipe.

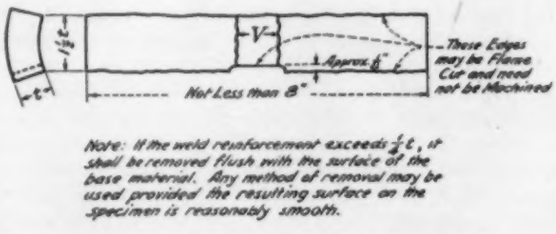

These Edges may be Flame Cut and need not be Machined
Approx. ½"
Not Less than 8"
Note: If the weld reinforcement exceeds 1/8 t, it shall be removed flush with the surface of the base material. Any method of removal may be used provided the resulting surface on the specimen is reasonably smooth.

Fig. 4. Side-Break Test Specimen for Pipe.

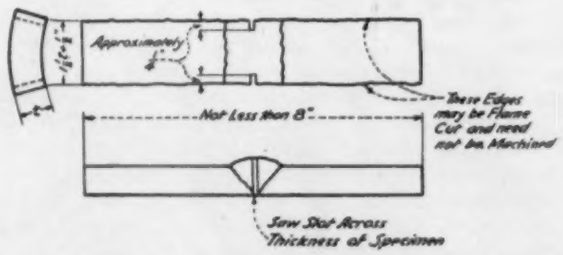

Approximately
Not Less than 8"
These Edges may be Flame Cut and need not be Machined
Saw Slot Across Thickness of Specimen

Fig. 5. Nick-Break Test Specimen for Pipe.

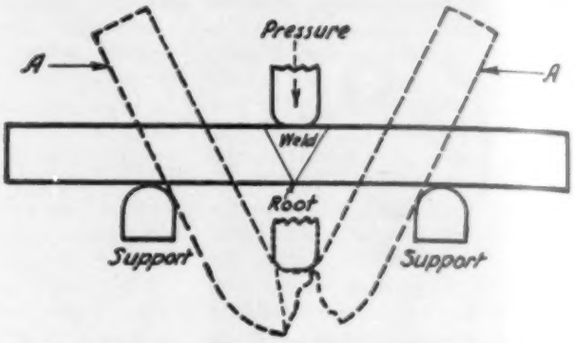


Fig. 6. Method of Testing Root-Break Test Specimen.

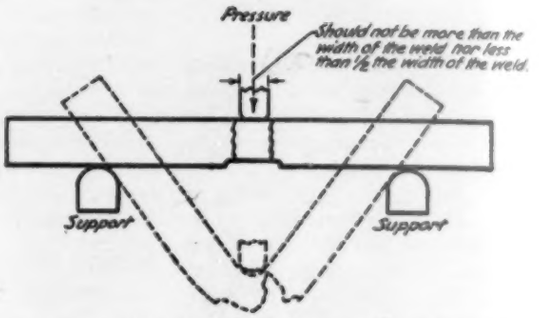


Fig. 7. Method of Testing Side-Break Test Specimen.

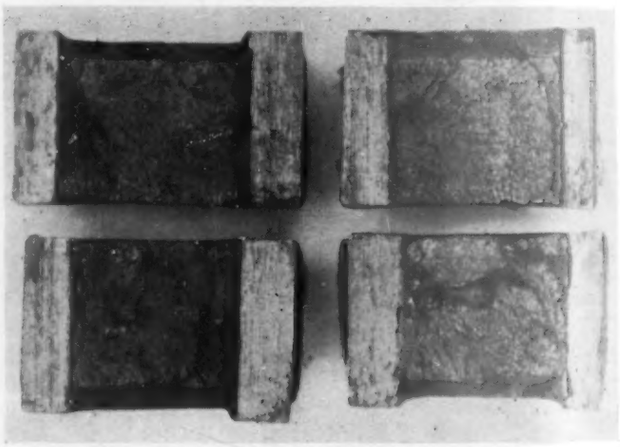


Fig. 8. Four Nick-Break Test Specimens After Fracture.
(All four specimens broke through from notch to notch. Two of these were broken with a quick, sharp blow, and two by slow bending.)

Fig. 9. Three Side-Break Test Specimens After Fracture.
(All specimens broke through the side-wall defect, thereby proving the worth of this type of test. The defect was not revealed in the nick-break tests shown in Fig. 8.)

tensile strength of the pipe material.

Free-Bend Test. The ductility by the free-bend method shall be not less than 20%.

Soundness. The permissible total depth of all zones of defects on any plane parallel to the throat of the weld shall not exceed 10% of the specified weld-throat dimension in the case of fillet welds, or of the thinner of the two parts joined in the case of butt welds. The length of any permissible defect, measured on a line perpendicular to the throat of the weld, shall not exceed ½ in. Defects are defined as gas pockets, slag inclusions, and lack of fusion exceeding 1/16 in. in greatest dimension. For single-welded butt joints without backing rings, all defects in a zone of 10% of the pipe-wall thickness at the root of the weld may be disregarded.

Tests of Specimens Removed From the Completed Line

When joints or specimens of joints are removed from the completed line for examination, no single zone of defect in excess of 10% nor a total of all zones in excess of 20% of the pipe-wall thickness will be permitted. The 10% zone at the root of the weld in single-welded joints without backing-up strips will be disregarded and the ½-in. limitation on the length of a defect will not apply to lack of fusion between layers of welding.

If the defects found exceed 50% of the wall thickness, the work of that welding operator will not be accepted. If the defects exceed the 20% limit given above but not the 50% limit, two additional joints or specimens for each welding operator will be removed. Should these additional joints meet the 20% requirement the work of that welding operator will be accepted. However, if either one of the additional joints or specimens show defects exceeding the 20% limit, the work of that welding operator will not be accepted.

When a complete joint is removed from the line, examination will be made by a root-bend test of specimens taken at the top, bottom and two sides of the joint, and all specimens must meet the requirements. If they do not, the remainder of the joint may be subjected to the root-bend test and judgment of the joint made upon the average condition of all specimens.

It must be understood, however, that even though the specimens may technically meet the requirements, the inspector shall have the right to call for additional specimens if, in his judgment, further investigation is necessary to satisfactorily determine that the welding is safe.

The matter of position in which the welding is done is of paramount importance, and a procedure of welding should be investigated not in one position but in all positions that might be encountered in actual construction, and an individual welding operator should be examined for his ability in all positions. Furthermore, it must be borne in mind that the average welding qualification test is made under the most advantageous conditions and surroundings. Frequently the welding operator will encounter much more difficult conditions and more unpleasant surroundings on the actual job.

I appeal to those of you who have responsible charge of welding to give serious thought to these matters and determine to your own positive satisfaction, and not by the word of any other person, that a certain technique of welding which you may decide upon is proper, and that you insist that such technique be followed in executing work for which you are responsible.

As regards the requirement that a welded joint or sample from a welded joint be cut from the work of every welding operator, I want to bring to your attention some very pertinent facts. A welding operator may demonstrate his ability to make a sound weld by a given process and under the most adverse conditions. Human beings are at times, however, peculiar individuals in that, while they may have the ability to do a certain job, they do not always extend themselves to accomplish the results of which they are capable. We know of several instances of welded pipelines that have been constructed by operators who had demonstrated their ability to make sound welds, yet joints have been cut from the line and unsound welds have been found.

Operator Needs Encouragement to Do Consistent Work

A constant prodding thought in the mind of a welding operator to encourage him to do his best work at all times will have a most beneficial effect and will, I am certain, be the most effective instrument that can be used to secure properly welded joints. Certainly no competent and conscientious welding operator could possibly object to such a procedure. Both employer and employe, knowing that a sample of the actual work will be examined, but not knowing just where the sample will be taken, are stimulated to continuously endeavor to avoid the penalties attached to unacceptable work.

I have appealed to those of you who have welding in charge to interest yourselves in the fundamental requirements of welding and the procedure that should be followed to obtain welded joints of proper quality. In this connection I am fearful that at times the welding operator has been asked to undertake work that is, in general, rather difficult of accomplishment. Although, under test, acceptable results may be obtained, the procedure adopted is so difficult that only by the most rigid attention to his work may the operator obtain a soundly welded joint. I have in mind in particular the question of the amount of molten metal that a welding operator is asked to control and which our experience has shown may often interfere seriously with his doing good work.

When the oxyacetylene process is used, I recommend for your earnest consideration the adoption of multiple-layer welding on pipe lines, and in connection therewith I call your attention to the papers presented on the subject at the recent meeting of the American Welding Society in Cleveland.

There is a bright future for fusion-

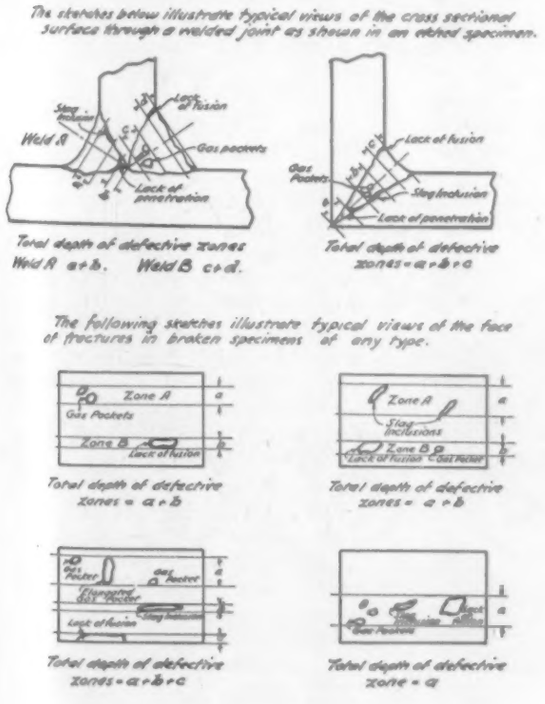

The sketches below illustrate typical views of the cross sectional surface through a welded joint as shown in an etched specimen.
Weld A
Gas pockets
Lack of penetration
Total depth of defective zones Weld A a+b. Weld B c+d.
Lack of fusion
Slag inclusion
Total depth of defective zones = a+b+c
The following sketches illustrate typical views of the face of fractures in broken specimens of any type.
Zone A
Gas Pockets
Zone B
Lack of fusion
Total depth of defective zones = a+b
Slag inclusions
Total depth of defective zones = a+b+c
Total depth of defective zone = a

Fig. 10. Typical Cases of Zones of Defects.

welded pipelines. That future will be safeguarded by your determination that every contact you have with that industry will be toward the certain assurance that high-quality welding will be done at all times.

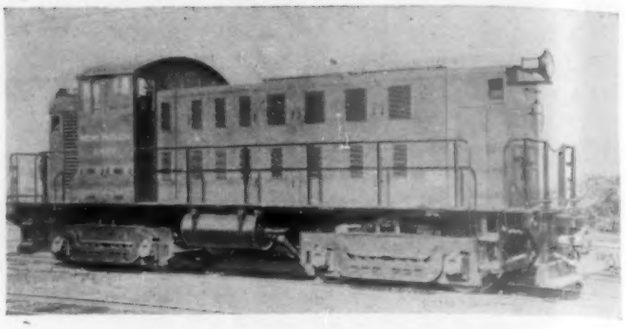
Switching Locomotives of Welded Construction

Ten diesel-electric switchers, a few of which have already been delivered, have been ordered by the New York, New Haven & Hartford Railroad Co. for use in terminals to give 24-hour service. Each of these will be able to do the work of a steam locomotive of the T-2-b class as well as part of the work of a locomotive of the Y-3 class. They will be limited to a maximum speed of 25 miles per hour.

All-welded construction is a feature of these units. While this type of construction had been looked upon favorably as a future development, just at this time it seemed like a radical proposal. When it was considered, however, that extensive welding had already been employed in locomotive construction, a considerable number of recent electric locomotives having all-welded cabs, for instance, and when the advantages of such fabrication, if successful, in reducing maintenance trouble and expense were taken into account, it was decided to accept welded construction for both trucks and cabs. An additional item of assurance in this respect was that the welding was to be done by one of the developers of the art—namely, the General Electric Co., who is the builder.

The use of axle-hung traction motors, high-speed opposed-piston air compressors, and the elimination of auxiliary generators, the main generator supplying auxiliary power at all speeds, were further departures from conventional locomotive design.

The all-welded construction is perhaps the most noteworthy feature of the mechanical structure, including the truck frames. Concomitant with the progress being made in welding is increased confidence in its use for railroad work. Welded cabs are now accepted without much question. Welded platforms also are rapidly being accepted. The last stand of distrust in welding, of course, comes in its application to truck construction and this should be overcome as such applications as the New Haven switchers demonstrate that welding can now be controlled and will prove reliable.



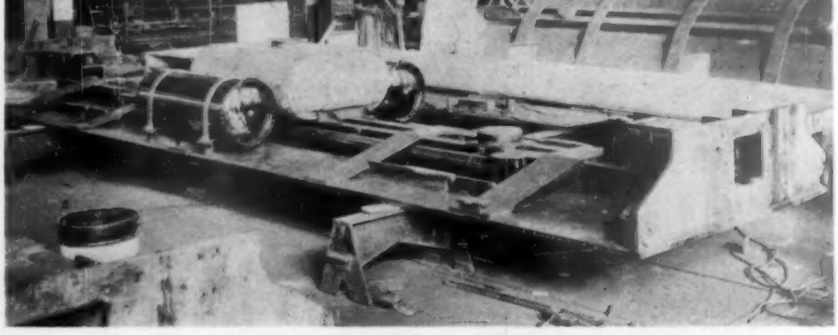
All-Welded Diesel Switch Engine.

(Ten of these have been ordered by the New Haven Railroad. The all-welded locomotive is said to be the most economical in manufacture and maintenance.)

The truck is built up of structural shapes and plates knit together by heavy fillet and plug welds. The finished frame is rigid, tough and highly resistant to the shocks of normal service. But the true test came in a severe derailment in which one of these locomotives was involved through no fault of its own, and these trucks proved themselves less subject to damage than those of other construction.

The weight of the locomotive is carried entirely on nests of coil springs mounted between the truck frame and equalizers. The construction is simple and the riding qualities of the locomotive exceptionally good.

The underframe is built up around a main slab, 37 ft. 11¼ in. x 117 in. x 1½ in., forming the platform and mounted on two center sills, each 37 ft. 7½ in. x 10 in. x 6½ in., running the entire length and forming a tremendously stiff "backbone" for absorbing buffing shocks as well as supporting the main items of equipment. Bumper beam, box structure for reinforcing the ends, draft-gear housing, bolster plates, center bearings and buffers are wholly fabricated by welding.

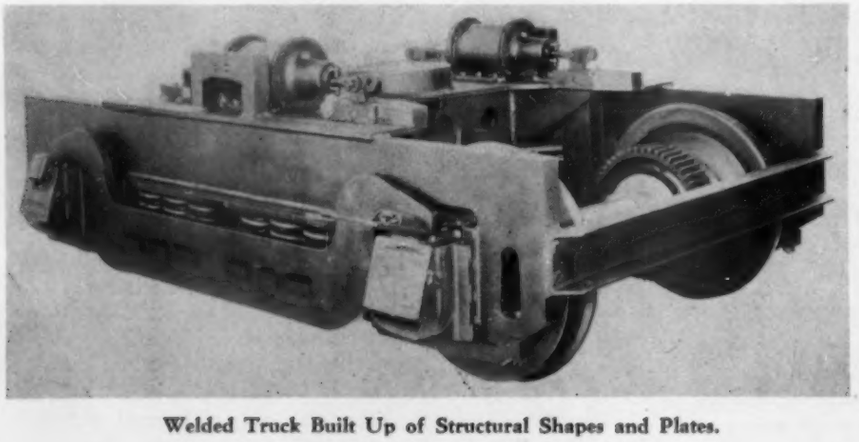


Under Side of the Locomotive Frame During Fabrication.

The cab and hood are of welded construction throughout. A section of the hood over the engine-generator set may be removed without disturbing any of the major piping. For minor work on top of the engine, a hatch is provided in the roof. Accessibility of all equipment in the locomotive was one of the major objectives of the design, in order to assure low maintenance costs.

Copper tubing is used in all water, fuel-oil and lubricating-oil lines, saving space, preventing corrosion, and making a more accessible piping layout. Except where unions are necessary to remove apparatus, sweat fittings are used, which gives an exceptionally tight installation.

Provisions are made for heating the locomotives in cold weather from an external steam supply when the diesel engine is shut down.



Welded Truck Built Up of Structural Shapes and Plates.

Get "H. O. T." on Welding

By H. O. T. RIDLON

Preheating

Preheating for a welding shop is often something of a problem. Of course, I like my good old charcoal—but sometimes charcoal isn't always handy. The kerosene heaters are good. City or natural gas are fine with a good preheat blower.

There's a lad—C. F. Hale—who runs a welding shop down at Wilmington, Ohio, who has developed a swell blower for natural or city gas. Recently there was a shop that didn't have city or natural gas—did not want to use kerosene—so tried one of these with propane. That's a low-flame-temperature gas that comes in 60- and 100-lb. steel bottles. Well sir, it worked swell, so I'm reporting it because I know that a lot of shops are looking for just that sort of thing.

This bottled gas has several advantages—among them being, if you have to go out on a preheat job, you can easily take it to the job. It gives a very hot flame. There is no liquid to spill. Its advantage over charcoal is that you use just what is necessary. And on an outside job, it is easy to return to the shop. The flame is clean and has no carbon.

But with propane you must be sure that *all connections are tight*. You *must* light the blower the very second the gas starts to flow. Be sure that any valves on this type of machine, when used with propane, are of the diaphragm type, and therefore leakproof, because this gas will soon eat out any packing, and that the valves are positive in shut-off. Also, you should use nothing but good hose and a regulator (acetylene will do) that is working right and has no leaks.

If you have any further questions to ask regarding this setup, don't hesitate to write me.

• • •

Running the Biz

This is to the job-shop owners—so the rest of you guys can skip this part. I'll come to you all further on.

A couple of months ago, I said I'd see what I could do about cost cards. Well, here they are. You can get them with 75 original and 75 copies, numbered in triplicate, as shown, bound with two carbons, in a book which weasures 4⅛x7 in.—Just a convenient size for desk or pocket. The "customer's check" is perforated so that it remains an "ad" with your customer while his work is in your shop. The original remains with the job until called for by the customer. Then it is filed away in the office with the duplicate, which completes the information, to show you just how you came out on the job.

A number of you guys have written me stating that you'd be interested in getting these. Now I've got to have orders from eight shops to get the price down. Each shop must order 125 books—and on the customer's check will be imprinted the shop's name, address and 'phone number. It will cost $25 for the 125 books—which, in most cases, is much cheaper than mimeographed forms.

• • •

A. W. S.

Some of you keen, far-seeing lads have joined the American Welding Society after my comments last month.

But more of you youngsters and welders have said to me: "Why should I spend my ten bucks to become a member? I go to the meetings and most of the stuff I hear is over my head. The same goes for the *Journal*. After all, I'm only a welder, but getting along O.K.—or words to that effect.

Because I feel that there are a number of youse guys who feels the same way, but haven't come back at me, I just want to say that's just the reason you should join the American Welding Society without any urging. If you put on your thinking cap for a minute, such remarks will prove to you that there's a lot about this welding business you don't know. That there's a mystery—if you will—about it that you should dig into and find out what it's all about. Because it's the welders of today that will become the gray beards of the industry tomorrow, if they so elect to be. The gray beards of today won't live forever and someone must take their places. Now let me put in a word for these gray beards for you guys that don't know 'em. They're perfectly grand regular guys, who like to hunt, fish, ride horseback, sail, swim, play golf, etc., just as you and I—and take a drink or leave it alone—100% on their job always.

The very fact that at the meetings and in the *Journal* of the American Welding Society are things that you don't understand—that are over your head—is a challenge to you that you don't know it all — that you should read and study more, go to night school, take up mathematics, chemistry, physics, etc., etc.,—that you should become an active and intensely interested member in all the doings of the American Welding Society.

And if you happen to be a salesman who earns his living from the welding industry, you should by all means support the society that has and is making it possible for you to have your bacon and beans regularly.

A penny postal card sent to me, asking for an application blank, will get one on its way to you pronto! Do you accept the challenge?

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Ingenious Home-Made Forge

Up in Cleveland, Art Starling, who runs the Ace Welding Shop, gets the "flash" of the month. He found it necessary to cut down on some of his heating jobs, and figured that he ought to build a forge.

So he got an old tire rim, and to this he welded a ¼-in. piece of boiler plate. In the center of this plate, he drilled

Name_____
Address_____
City_____
Date Rec'd_____
Date Promised_____
Article_____

Welder_____
Welder's Time_____ Hrs. @_____ Cost_____
Helper's Time_____ Hrs. @_____ Cost_____
Total Labor Cost_____
Preheat Fuel_____ @_____ Cost_____
Oxygen_____ Cu. Ft. @_____ Cost_____
Acetylene_____ Cu. Ft. @_____ Cost_____
Welding Rod_____ Lbs. @_____ Cost_____
Power_____ Hrs. @_____ Per KWH_____
Miscellaneous Items_____
_____ Cost_____
_____ Cost_____

CUSTOMER'S CHECK
THE WELDALL SHOP
106 NORTH MULBERRY ST. MANSFIELD, OHIO

Description of Job_____

Price Quoted_____
Date Promised_____

Name_____
Address_____
City_____
Date Rec'd_____
Date Promised_____
Article_____

Welder_____
Welder's Time_____ Hrs. @_____ Cost_____
Helper's Time_____ Hrs. @_____ Cost_____
Total Labor Cost_____
Preheat Fuel_____ @_____ Cost_____
Oxygen_____ Cu. Ft. @_____ Cost_____
Acetylene_____ Cu. Ft. @_____ Cost_____
Welding Rod_____ Lbs. @_____ Cost_____
Power_____ Hrs. @_____ Per KWH_____
Miscellaneous Items_____
_____ Cost_____
_____ Cost_____

Total Labor & Material Cost_____

Price Quoted
Overhead_____ % Labor_____
Total Cost_____
_____ % Profit_____
Am't. to be charged $_____

Original and Duplicate Pages of the Cost Card.
(The original contains a customer's check, which is torn off on a perforated line. Under this on the duplicate are spaces for profit data.)

about twenty-five 3/16-in. holes in about a 9-in. diameter circle. On the underside, he welded a piece of sheet metal, formed so that it comes down to about a 2-in. opening. Of course, he welded on some legs (three) out of 1-in. pipe. He uses a high-volume, low-pressure blower, similar to the one I described above. This he hooks up with a piece of hose to his forge. In the forge he uses blacksmith coal, starting the fire with wood chips; and when it gets going, he turns on the motor of his blower and gets a very hot, satisfactory fire right now, with the air forced through the coal.

This is a very useful accessory which any welder can make out of scrap material. Really, no shop is complete without one.

• • •

The thought for the month: It doesn't make much difference what you go through—what counts is the way you come through it!

• • •

The thought for the Year: Be what those who love you want you to be.

• • •

A very Merry Christmas to all of you and my sincere hopes that the New Year will bring you nothing but good luck.

Welded Ladle Results in Economies

A hot metal ladle of welded construction, designed by the Bethlehem Steel Co., virtually halves dead weight in the tapping and pouring of steel. It holds 120 tons of molten metal, yet it weighs only 31,000 lb. The older design of ladle that it supplants weighs 55,000 lb. and holds but 100 tons of hot metal.

The new ladle is elliptical instead of circular in its horizontal cross-sections. It was designed to meet a specific problem in several of the Bethlehem open-hearth units where melts were being increased from 100 to 120 tons. To hold this increased tonnage of hot metal, it was self-evident that the new ladle would have to be either taller or of greater circumference. Increasing the height of the ladle would have resulted in the disadvantage of increased hydraulic head. Therefore, by making the horizontal cross-sections elliptical rather than circular it was possible to increase the capacity of the ladle without lengthening the distance between trunions. Thus the same trunion hooks can be employed that were originally designed for the smaller 100-ton ladle.

The welded ladle is so much lighter that it goes far to offset the added working loads that the greater tonnage of hot metal imposes on the handling equipment. The welded construction made possible the direct attachment of the trunions to the ladle, and weight was saved throughout because of the lighter plates that could be used without sacrifice for strength.

There was also a saving in weight in the trunions, in which welded reinforced shoulder construction was substituted for castings. Essential strength for the bottom construction was secured by the use of welded-in 2x6-in reinforcing bars in conjunction with a flat plate rather than a flanged section, the use of which was precluded, in any case, because of the ladle's elliptical shape.

C. D'W. Gibson Elected President of I. A. A.

C. D'W. Gibson, who was elected president of the International Acetylene Association at the annual convention recently held in St. Louis, has been associated with the Air Reduction Co., Inc., of New York City, since 1919, and is now assistant vice-president and general sales manager of that company. He has been active in the affairs of the International Acetylene Association for several years, serving as a member of both the Executive Committee and the Program, Publicity and Arrangements Committee. At the 1935 convention of the Association, he was elected vice-president. Other societies in which he is active include the American Welding Society and the American Iron and Steel Institute.

C. D'W. Gibson, Who Heads the International Acetylene Association.

Atlantic City Selected for 1937 Metal Show

The 1937 Metal Congress and Exposition will be held October 18 to 22 in the Atlantic City Auditorium, in Atlantic City, N. J., says an announcement from W. H. Eisenman, managing director of this annual show and national secretary of the American Society for Metals. This is the first time this important metal event will have been staged outside an industrial city.

Mr. Eisenman pointed out that it has been the practice to hold the Exposition in a different section each year. "In 1935, the Show was staged in Chicago, this year it was Cleveland, and in 1937 the schedule called for a visit to the East," he said. "Atlantic City was selected by the board of trustees of the American Society for Metals because of its marvelous Auditorium and convenient and adequate hotel facilities. The huge Auditorium offers every facility for making this 19th annual Metal Exposition the largest and most attractive ever presented to the thousands of metal men whose job it is to solve the world's metal problems."

The policy, which proved so popular at this year's exposition, of opening the show only to those men actively interested in production and use of metals, will be continued at the 1937 show, Mr. Eisenman announced.

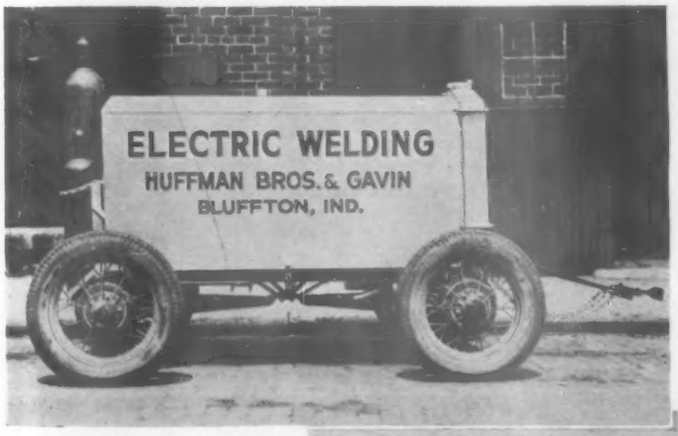
Welded Ladle for Hot Metal.

(This holds 120 tons of molten metal, yet weighs but 31,000 lb., about half the weight of the older design of ladle which it supplants.)

Welding News in Pictures

• Dr. D. S. Jacobus receives the Morehead Medal from Philip Kearny, at the annual meeting of the International Acetylene Association, held recently in St. Louis. Others in the group are H. L. Whittemore, of the National Bureau of Standards; C. O. Epperson, retiring president of the I. A. A.; and H. F. Reinhard, secretary of the I. A. A.

• Saw teeth on a rotary caisson being cut, bent and hard-set for abrasion resistance by means of the oxyacetylene flame. These teeth must stand the hardest wear as they literally saw their way down into the earth. (Photograph by courtesy of The Linde Air Products Co.)



• (Left) Portable electric welder put together in three days by Huffman Brothers & Gavin, Bluffton, Ind. The owners frequently tow this unit to the job at 40 to 50 miles per hour. It carries a fire extinguisher and first-aid kit.

• (Right) This welded trailer, 47 ft. 9 in. long by 11 ft. 6 in. wide, is believed to be the largest trailer ever equipped with pneumatic tires. It is of 30-ton capacity and was made by the Rogers Bros. Corp., of Albion, Pa., for a Los Angeles customer for hauling steam shovels. Welding was done by the shielded-arc process. (Photograph by courtesy of The Lincoln Electric Co.)

Welded Rigid Frames for Single-Story Buildings

A new design for single-story industrial buildings, providing broader factory aisles, unobstructed head room to full ceiling height, and maximum uniform daylight throughout, has been developed by the Austin Co., Cleveland, O., through the use of welded rigid-frame construction.

Entirely stripped of cross-members and trusses, which cast spider-web shadows across most factory areas today, the new type has a continuous rigid saw-tooth frame formed by the welding of rolled beam sections which permit economical construction of aisles up to 50 ft. in width. It is particularly adaptable to requirements of machine shop, precision-parts production, and the textile, food and printing industries, where air-conditioning is a factor of increased importance.

"Application of the latest engineering practice will permit the attainment of simple functional lines in plants of the future," Albert S. Low, vice-president and chief engineer of the Austin organization, states. "By taking advantage of a system which utilizes the controlled elastic deformation of structural steel in a building of the saw-tooth type, it will be possible to eliminate all passing shadows caused by transitory sunlight and to insure more efficient and uniform artificial illumination at night. The advantages of saw-tooth construction have long been recognized, but until now these have been confined to the glareless qualities obtained by facing monitors to the north. With all non-functional members eliminated, the new type will give unobstructed space for ventilating or air-conditioning ducts, pipes, and other functional equipment.

"With broader aisles available, and clear unobstructed head room from floor to roof, men responsible for production will have the maximum opportunity to develop efficient and flexible operating layouts for the future. Straight-line operations in any of several directions will be possible."

Extensive research carried on at The Austin Co. fabricating shops in Cleveland preceded announcement of the revolutionary new industrial building type, which, according to Mr. Low, adapts the natural tree form of structural design to industrial purposes. European engineers have applied similar technique in their factory construction, due to its more efficient utilization of steel.

"With labor costs relatively low and steel at high prices abroad, they turned to this type of design as an economy measure," he said. "With steel prices relatively low and labor high in America, this technique was not exploited, but now welding offsets the differential in labor costs and brings rigid-frame construction down to a more reasonable level. It is bound to find widespread application in the period of industrial building immediately ahead of us."

Meetings

Chicago

The meeting of the Chicago Section, American Welding Society, to be held on Friday, Jan. 15, in Mission Hall at Armour Institute of Technology, will be devoted to "Welding Non-Ferrous Metals." Clinton Swift, of The American Brass Co., Waterbury, Conn., will be one of the speakers, the others to be announced later.

The Chicago Section held a joint meeting with the Maintenance-of-Way Club of Chicago on Dec. 14. "Welding and Heat-Treating Rail Ends" was the subject of talks by Armstrong Chinn, of the Chicago & Alton R. R., and C. B. Bronson, of the New York Central Lines, the former dealing with the gas process and the latter with the electric process. S. E. Tracy, of the Chicago, Burlington & Quincy R. R., gave a paper on "Welding Open-Hearth and Manganese Frogs." E. J. Brown, of the Chicago, Burlington & Quincy R. R., was chairman of the meeting, and Lem Adams, of The Oxweld Railroad Service Co., was technical chairman.

Detroit

A. E. Gibson, president of the American Welding Society and vice-president of The Wellman Engineering Co., Cleveland, O., spoke on "Low-Alloy Steels in Welded Equipment" at the meeting of the Detroit Section, American Welding Society, held on Dec. 4. Lantern slides were used.

Los Angeles

"Welding of Oil-Well Casing" was the subject of a talk by Walter C. Main, field engineer, Youngstown Sheet & Tube Co., at a meeting of the Los Angeles Section, American Welding Society, on Dec. 3. Turner C. Smith, Pacific Coast vice-president of the American Welding Society, who is in the engineering department of the General Petroleum Corp., spoke regarding the annual meeting of the American Welding Society and the National Metal Exposition, both recently held in Cleveland.

Milwaukee

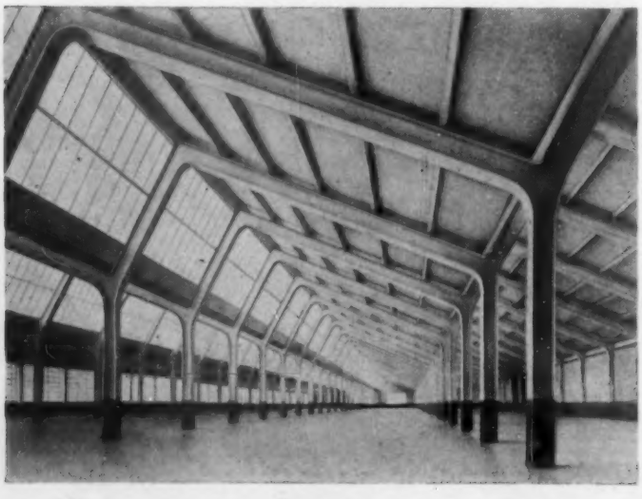
"Principles of Resistance Welding and Construction Features of Special Resistance-Welding Machines" was the subject of a talk by C. L. Pfeiffer, electrical engineer, Western Electric Co., Chicago, at a meeting of the Milwaukee Section, American Welding Society, held on Dec. 9.

New York

The New York Section, American Welding Society, have scheduled a joint meeting with the American Society of Mechanical Engineers for the evening of Jan. 11 on "Locomotive and Stationary Boilers." During the month of January three lectures on the course devoted to "Fundamentals of Welding" will be given, as follows: Jan. 5, "Inspection and Supervision of Welds," by E. R. Fish, of The Hartford Steam Boiler Inspection & Insurance Co.; Jan. 19, "Welding Alloy Steels and Cast Iron," by A. B. Kinzel, of the Union Carbide & Carbon Research Laboratories, and Jan. 26, "Welding Non-Ferrous Metals and Alloys," by L. E. Abbott, of the Bell Telephone Laboratories.

Philadelphia

"Railroad Welding Practice" is the subject tentatively planned for the meeting of the Philadelphia Section, American Welding Society, to be held on Monday evening, Jan. 18.



Welding Saves Industrial Space.

(This new design for buildings provides broader aisles, unobstructed headroom, and maximum uniform daylight.)

San Francisco

"A Review of Recent Developments in Low-Alloy-Steel Welding" was the subject of a talk by Prof. N. F. Ward, of the Department of Mechanical Engineering, University of California, given before the San Francisco Section, American Welding Society, held in Oakland on Nov. 20. Mr. Ward also discussed the annual meeting of the American Welding Society held in Cleveland, and outlined the plans of the national organization. K. V. King gave his usual interesting review of the outstanding articles on welding appearing in the society's *Journal* and in other literature. Many of those attending made their first trip over the magnificient new San Francisco-Oakland Bay Bridge, recently opened to traffic.

Innovations Draw Crowds at I. A. A. Meeting

Round-table discussions, a forum on welding and cutting, and a visit to a large fabrication plant manufacturing pipe fittings and assemblies, were additional features to the technical papers program presented at the 37th annual convention of the International Acetylene Association, held in St. Louis, Mo., Nov. 18 to 20.

The round-table discussions were one of the high-lights of the convention and drew an attendance of more than 500, each of whom was given the opportunity to join any one of nine discussion groups on the following subjects: (1) welding high- and low-alloy steels, (2) safety in the handling and use of oxy-acetylene equipment, (3) codes, and welding design and construction, (4) merchandising welding-shop services, (5) hard-facing, (6) welding and cutting in engineering education, (7) oxy-acetylene cutting, (8) non-ferrous metals and their welding characteristics, and (9) qualification and training of welding operators to meet code requirements. After a preliminary meeting in the auditorium of the Soldan High School, each group, carrying its individual banner, proceeded to the class room assigned it in the building, where a chairman, with his technical advisers, lead and directed the discussion on the assigned topic. During the evening, opportunities were given all in attendance to change from one group to another, several different times, thus allowing all to partake in discussions in three or four different groups. High interest was shown in all these group discussions, with the greatest attendance in the following groups: hard-facing; non-ferrous metals; and codes and welding design and construction. Because of the success of this first round-table effort, the Association will very likely make it a regular feature at all future conventions.

Several hundred of those in attendance took advantage of the inspection trip to the plant of the Midwest Piping & Supply Co., Inc., where they obtained information on this company's procedure for testing and qualifying their welders, and saw in operation their methods of producing welding pipe fittings of different types, in a large variety of sizes. The visitors showed great interest in various work that was under way in the shops, including the heating and bending of large pipe, manufacture of pipe coils, flanging of pipe, manufacture of welded pipe assemblies, and some interesting examples of contractors' grading equipment built with pipe framework.

As is usual at these conventions, the forum drew the largest attendance, over 1600 attending this event, which was held in the Soldan High School Auditorium.

Considerable interest was shown in many of the technical papers presented before the convention, held in the Hotel Jefferson. More than 500 persons were registered at these meetings.

The reports of the officers and committees, given at the annual business meeting, indicated a healthy condition of the Association as regards both membership and finances, and an active continuation of the work of all standing committees.

The report of the Nominating Committee was adopted, and the following officers elected for the ensuing year: President, C. D'W. Gibson, general sales manager, Air Reduction Co., Inc., New York City; vice-president, Elmer H. Smith, Commercial Gas Co., Minneapolis, Minn.; secretary, H. F. Reinhard, Carbide & Carbon Chemicals Corp., New York City (reelected), and treasurer, Henry Booth, sales manager, Shawinigan Products Corp., New York City (reelected).

Book Reviews

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE. 4th Edition. 5¾ x 9 in.; 819 pages, 990 numbered text illustrations. Semi-flexible simulated leather binding, gold embossed; price in U. S., $1.50 per copy; outside U. S., $2. Published by The Lincoln Electric Co., Cleveland, O.

This handbook needs no introduction to readers of *The Welding Engineer*, for during the comparatively short time since the first edition was published it has become known as a most authoritative source of information on arc welding.

The fourth edition of this valuable work will do much to maintain the reputation which this compilation has already earned, for it contains 223 added pages of the most recent data on arc welding, together with 289 new illustrations, including photographs and drawings, all necessitated by reason of the great progress made in arc welding since the third edition was brought out.

Among the more important topics upon which new data are presented are the following: Characteristics of the welding generator, selection of type of joint, insurance of fusion-welded vessels, welding codes, arc cutting, polarity of welding current, horizontal welds, sheet-metal welding, effect of electrode size on welding cost, methods of testing weld metal, 4-6 chrome steel, monel metal, principles of surfacing by welding, welded design begins with standard shapes and plates, plate girders.

The fourth edition is divided into nine parts, as follows: 1, Welding Methods and Equipment; 2, Technique of Welding; 3, Procedure, Speeds and Costs for Welding Mild Steel; 4, Structure and Properties of Weld Metal; 5, Weldability of Metals; 6, Designing for Arc-Welded Steel Construction of Machinery; 7, Designing for Arc-Welded Structures; 8, Typical Applications of Arc Welding in Manufacturing, Construction and Maintenance; 9, Advertising Section.

Encyclopedic in scope, concisely written and profusely illustrated, the handbook is a complete reference guide for all who are interested in arc welding. Though written especially for designers, engineers, architects, production managers, welding supervisors and operators, the work also contains a wealth of data of interest to draftsmen, steel fabricators, erectors, foremen, cost estimators, maintenance managers, shipbuilders, piping and pipeline contractors, and students of welding.

* * *

BOOK OF A.S.T.M. STANDARDS, 1936 ISSUE, PART I. 6 x 9 in.; 898 pages, numerous illustrations, charts and graphs. Cloth binding; price, $7.50. Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa.

Of the 181 standards in Part I of this work, 109 cover the ferrous metals, steel, wrought iron, pig iron and iron castings and ferro-alloys, while 60 relate to non-ferrous metals, including aluminum and magnesium alloys, copper and copper alloys, lead, nickel, zinc, bearing metals, solder metal, deoxidizers, electrical heating and electrical-resistance alloys. Twelve of the standards involve metallography and general testing methods.

Among the principal ferrous materials covered are: Structural and rivet steel, boiler steels, steel for welding, steel castings, steel tubes and pipe, steel for high-temperature service, zinc-coated steel and iron articles, wrought iron, pig iron and iron castings.

Among the 60 standards relating to non-ferrous metals are the following classifications: Aluminum alloys, copper and copper alloys, lead, nickel, solder metal, white metal, zinc.

Other standards in Part I cover grain size for classifications of steels, metallographic testing of steel and of non-ferrous metals and alloys, radiographic testing of metal castings, thermal analysis of steel, Brinell and Rockwell hardness testing, tension testing of metallic materials and definitions of terms relating to metallography, to methods of testing and to specific gravity.

New standards adopted in 1936 for twelve different groups of materials are covered, as are revisions in some 35 existing standards of metallic products.

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NEMA ELECTRIC ARC-WELDING MACHINE STANDARDS. 8 x 10½ in., 18 pages, paper covered; price, 50c. Published by National Electrical Manufacturing Association, 155 East 44th St., New York, N. Y.

This new publication of NEMA is a reference work of practical information concerning the manufacture, test and performance of direct-current and alternating-current arc-welding machines, such as motor-generator sets, dynamotors, transformers and rectifier arc-welding sets.

It is expected that these standards will assist in harmonizing practices in the industry and promote production economies. They also clear up many troublesome problems for the buyer of arc-welding equipment, and define numerous terms which have hitherto been subject to various interpretations.

Torch Replaces Shears at Bridge-Opening Ceremonies

A significant event in the history of oxyacetylene cutting occurred on Nov. 12 at the opening to traffic of the great highway bridge connecting San Francisco and Oakland, Calif. The event was no less than the introduction of flame-cutting as part of the impressive ceremonials marking the beginning of traffic flow by vehicles between the two cities.

It has been a time-honored custom when a new bridge was opened for the chief executive of the state or the city to cut a red-white-and-blue ribbon stretched across the roadway and thus symbolize the removal of a barrier to quick and easy transportation. But times and customs change. New methods, new processes and new tools might be and perhaps should be symbolized also at such auspicious events, when they have played an important part in bringing a great new bridge into being. Thus it was reasoned and thus it was brought about by H. W. Saunders, San Francisco district manager for the Air Reduction Sales Co., that the ancient ribbon-snipping

Governor Merriam Cuts the Chain.

with shears was displaced by cutting a chain with an oxyacetylene torch—a steel chain overlaid to represent gold, and called a "golden chain."

Eventually an emergency cutting torch was wielded by the chief executive of the State of California—Governor Frank S. Merriam—thus symbolizing the removal of the barrier to traffic flow.

But the governor and his aids did not immediately see the logic of the proposal. Saunders' most persuasive eloquence, backed by a precedent quite far removed from bridge openings—the exploit of Admiral Plunkett back in 1923 when he used a cutting torch to initiate the Navy's part in the international disarmament scrapping program at the Brooklyn Yard—finally persuaded the California executive that this signal departure from custom would not be unpatriotic, but in good taste. In fact, the governor became such an enthusiast of the idea that he insisted that chains be used instead of ribbons at the middle of the bridge and at the Oakland end, and he cut each of these with a torch as he progressed along the bridge during the ceremonies.

The stands supporting the chains had bases consisting of square pieces of 2-in. armor plate flame-cut from the old *U.S.S. Frederick*, scrapped at San Francisco in 1930. The stands were I-beams that had been sandblasted and metal sprayed with aluminum. Mounted on each stand was a large bear, also flame-cut out of ¼-in. plate. A smaller bear in the center of the chain clanged on the cement pavement when the chain was cut.

Welded Building for Shipyard Welding

To insure continuous operation and prevent delays from unfavorable weather conditions in carrying on open shipyard assembly under a large scale manufacturing program on welded hulls, the Dravo Contracting Co. of Pittsburgh, Pa., is erecting a building of welded construction. It will be 210 ft. long and 156 ft. wide. This assembly shop will enable the construction of boats and barges during their various stages of assembling and there will be sufficient floor capacity to build three barges at one time.

The building is constructed so that heat will be available during cold weather, which will permit welding, painting and testing of hulls. Transfer carriages will permit the moving of the vessels through the various stages until they reach the ways from which they are launched. There will be a full complement of 20-ton erection and 5-ton assembly cranes. Space also will be provided for offices for superintendents, surveyors and inspectors, while other modern conveniences will be installed.

Automotive Maintenance Show to Feature Welding

A welding school conducted by manufacturers of welding equipment will be one of the chief features of the first annual Northwest Automotive Maintenance Show in the Minneapolis Auditorium April 8-11, inclusive, under the direction of the Automotive Boosters Club, Northwest No. 8.

The show will be open only to men in the automotive field, and free tickets are to be distributed widely throughout Minnesota, North Dakota, South Dakota, and parts of Montana, Wyoming, Iowa, Wisconsin and Michigan.

Jobbers throughout the territory have pledged their support to the welding school, and a committee of jobbers is planning a campaign to insure a large turnout of dealers and service men. Preliminary estimates put the probable attendance at 25,000.

Rules for Testing Welding Processes and Operators

"Tentative Rules for the Qualification of Welding Processes and Testing of Welding Operators" have been issued by the American Welding Society, 33 West 39th St., New York, N. Y., in pamphlet form, to which comments, criticisms and suggestions are invited. These rules cover plate welding (either butt or fillet welds) and pipe welding. In the appendix, suggested sets of specifications are given, covering (1) oxyacetylene welding, (2) metallic-arc welding, and (3) carbon-arc welding. Copies of these rules can be obtained from the American Welding Society at 25 cents each.

Coming Events

Jan. 11-15. New Orleans, La. National Road Show, and meeting of American Road Builders Association. For information write Charles M. Upham, 952 National Press Building, Washington, D. C.

Mar. 18-19. Lawrence, Kan. Third Annual Welding Conference of University of Kansas. For information write A. H. Sluss, Professor of Mechanical Engineering.

Mar. 24-26. Ames, Iowa. Ninth Annual Welding Conference of Iowa State College, with exhibits. For information write D. C. Faber, Director, Engineering Extension Service.

What's New in Equipment and Supplies

Low-Range D.C. Arc Welder of Rectifier Type

A new departure in arc welding—a low range, direct-current welder, utilizing rectifier bulbs instead of rotating equipment, is being introduced by the General Electric Co., Schenectady, N. Y.

D. C. Welder Has No Rotating Parts.

The welder, designed to operate on 3-phase, 50- or 60-cycle power, 230, 440, or 550 volts, uses four mercury-Tungar bulbs.

The unit is said to have ample capacity for welding all light-gauge car or truck parts in construction and maintenance work. It can be used to fabricate metal roofs and ceilings, steel cabinets, blower and ventilating systems, and steam fittings. Moreover, it is said to give a "soft" arc—one of high stability. It is light in weight, easily portable, and has a current range of from 25 to 75 amperes (NEMA rating), controlled by a 9-point tap switch.

The unit is mounted on hard-rubber casters for easy moving, and weighs 140 lbs., net. Overall dimensions are 27 x 24 x 14 in.

Hard-Surfacing Electrodes for Manganese Parts

The Stulz-Sickles Co., 91 N. J. Railroad Ave., Newark, N. J., have introduced "Seaco" hard-surfacing electrodes for overlay welding of Manganal 11 to 13½% nickel managanese steel weld deposits, applicator and wedge bars, etc. They are not intended as building-up electrodes, but for supplying the final layor over Manganal.

According to the manufacturers, many hard-surfacing electrodes when applied over Manganal 11 to 13½% nickel-manganese steel and Hadfield 11 to 14% manganese steel become soft, due to the parent metal absorbing the various alloys contained in the hard-surfacing electrodes. Seaco hard-surfacing electrodes were developed to overcome this absorption and softening, and one layer over Manganal is claimed to give a weld deposit of 550-600 Brinell. While wearing through, this layer permits the Manganal to work-harden, consequently providing increased resistance against impact and abrasion.

A new folder describing Seaco hard-surfacing electrodes in detail, has just been issued.

Helmets and Handshields of New Design

An unusually high degree of comfort to the welder is assured by the use of the new helmets and handshields recently announced by Willson Products, Inc., Reading, Pa. Lapped-over seams and rivets are entirely eliminated, this being made possible by employing a new manufacturing process. The entire face is formed from one piece, and the elimination of lapped seams produces a saving in weight.

Shaped to conform closely to the contour of the head and face, these new devices are also cupped deeply to obtain close side protection to a point well back of the ears. Protection from reflections and flashes from nearby work is provided by the full turned edges, which run well back under the chin and above the head.

Helmet With Flip-Front Feature.

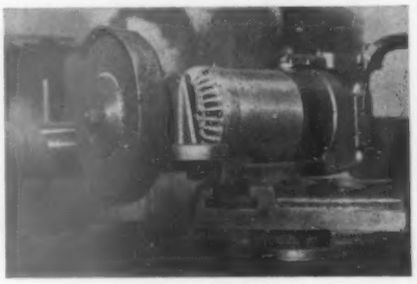
Hand Shield of One-Piece Construction.

Helmet With Composition Glass Holder.

These helmets and handshields also possess the usual features of such devices, and the helmets have a chin-rest bar to provide extra comfort when they are worn for long periods. Willson-Weld glass is standard in all these devices.

Toolpost Grinder for Sprayed Coatings

The new Mogul toolpost grinder is announced by the Metallizing Co. of America, 1351 East 17th St., Los Angeles, Calif. This grinder has been produced especially for use on metallized coatings, but the makers declare it will grind all types of toolpost work just as satisfactorily. The machine operates with a 1½-hp. constant-duty motor at a speed of 3,600 r.p.m., weighs 27 lb., operates on 220 volts, 3-phase, 50 to 60 cycles, and produces a fine surface finish on the work, it is said. A statement by the manufacturers says: "We have taken off 1/16-in. cuts with this grinder from high-carbon steel rods, after which a finish cut of 0.001 in. completed the job."



Grinder Mounted on Lathe Toolpost.

Welders Equipped With Current-Saving Switch

What is termed "selective motor horsepower control" is a feature of the new Hobart welders known as the "Series MN Current-Saving Models," recently announced by Hobart Brothers, Box U-126, Troy, O. These units also are improved with a new type of wheel mounting having a low center of gravity.

By starting on the "Low" point, only 1/3 the usual starting current is required. The power factor of the machine and its efficiency are both materially improved, it is claimed, and it is said to be possible to use the equivalent of a motor of one-half the horsepower rating for welding in ranges up to ½ or 2/3 the rated capacity of the generator.

By the use of this special switch, it is claimed that welding current costs are cut 30% to 50% in average work, that

New Hobart Series MN Welder.

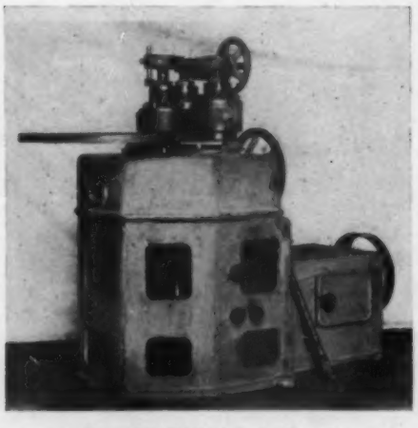
power company penalties due to poor power factor of equipment are avoided, that re-wiring of many plants is eliminated, and that idling and light-load power losses are cut in half. The power factor in the light-load ranges is said to be 90% or better.

The control is simple and easily operated. A convenient latch locks the handle in the "Low" position, at which the machine is started or used for welding up to one-half the rated generator capacity (up to two-thirds rated capacity for intermittent welding). To operate at higher rates, a convenient lever releases the handle for turning to the "High" position, where the full rated horsepower of the motor is available for full-load and overload welding. It is also possible both to start and weld in the "High" position without turning the handle to the "Low" setting.

These machines are available in various sizes from 75 to 600 amperes.

Schatz Angle Bending Machine Has Adjustable Rolls

The "Schatz-Herkules" machines for rolling angles, tees, beams, channels, flats, etc., are being introduced by the Schatz Manufacturing Co., Poughkeepsie, N. Y. These are available in various sizes, for bending the smallest angle and up to 8 x 8 x 1 in. They have a unique feature in that the rolls are adjustable for rolling the different profiles, eliminating the necessity of interchanging.



Adjustable-Roll Angle Bender.

The accompanying view illustrates Sizes B0-8 and B0-9 for rolling up to 2 x 2 x ¼ in. and 2½ x 2½ x 5/16 in. angles, respectively. The horizontal operation permits the easiest and safest handling of the longest bars and largest rings. The guide rolls have both vertical and radial adjustment, which, together with the special roll design, assures the production of rings or arcs absolutely true and round, without twisting of the material. Finished rings are easily removed. These machines may be had for either unit electric drive or belt drive.

New Line of Helmets and Handshields

A new line of arc-welding helmets and handshields, known as the "Turret-Top" line, has been placed on the market by the C. H. Dockson Co., 2889 E. Grand Blvd., Detroit, Mich. These new shields are light, safe, shock-proof, and sanitary, and are capable of withstanding severe service, the makers announce.

A rivetless face-piece formed from one seamless, heavy-gauge, fibre sheet eliminates the possibility of an electric shock through the shield and facilitates complete sterilization, it is claimed.

Built for Severe Service.

The Turret-Type construction allows the use of heavy-gauge fibre without increasing the weight, and insures long life. A lens holder made from a special oil-resisting rubber compound gives protection from flying sparks and hot particles, being at the same time so designed that light cannot penetrate to the interior of the shield.

The clear coverplate is easily and quickly changed from the front side without disturbing the more costly colored filter lens. The lens holder also acts as a shock absorber, should the shield accidentally be dropped. It can be removed from the helmet proper without tools for sterilization, cleaning or replacement.

All helmets are furnished with adjustable headbands equipped with detachable pads, which latter are replaceable without tools. The handshields are furnished with corrugated fibre handles, allowing the welder to obtain a firm, nonslip grip.

Electrode Can Be Used on Poorly Fitted-Up Work

The new electrode, known as Type N, has been added to the line of Murex electrodes manufactured by the Metal & Thermit Corp., 120 Broadway, New York, N. Y. It is designed for bridging gaps where fit-up between plates is poor and, in the smaller sizes, may be used on vertical and overhead work, or to make rapid, single-pass welds on light-gauge materials. In addition, it will produce clean, sound, single- or multiple-pass fillets.

The physical properties of the metal deposited by this new electrode are said to range from 74,000 to 84,000 lb. per sq. in. in tensile strength, with 26% to 24% ductility. The new electrode is also said to work equally well with either d.c. or a.c. and may be used either with straight or reversed polarity.

Trade Literature

Many interesting uses of monel metal in solving problems in industry are described and illustrated in an attractive 48-page booklet issued by The International Nickel Co., Inc., 67 Wall St., New York, N. Y. Several pages are devoted to structural and design data. The booklet includes 20 sub-divisions, each devoted to a specific field, such as hydroelectric and steam power plants, highway maintenance, refrigeration, automobiles, etc. In addition to standard monel, the booklet also describes some of the newer forms of this alloy.

"Airco Acetylene—the economical fuel gas for welding and cutting" is the title of a small pamphlet issued by the Air Reduction Sales Co., 60 East 42nd St., New York, N. Y., in which acetylene is compared with other fuel gases as to flame temperature, heating efficiency, heat value and oxygen consumption.

Two new bulletins on arc welders have been issued by The Lincoln Electric Co., Cleveland, O. Bulletin 314 describes the Model SA 150 welder, having a range of 45 to 200 amperes. Bul-

Tobin Bronze to the Rescue

AT 42° BELOW ZERO

Anaconda Welding Rod used to repair stalled tractor... and tie-up of large logging operation was prevented

Many times Tobin Bronze has been called upon for unusual and difficult repair jobs when disabled machinery threatened to lose money for owners. But never did it prove its value more thoroughly than in Manitoba last winter when the thermometer stood at 42° below zero.

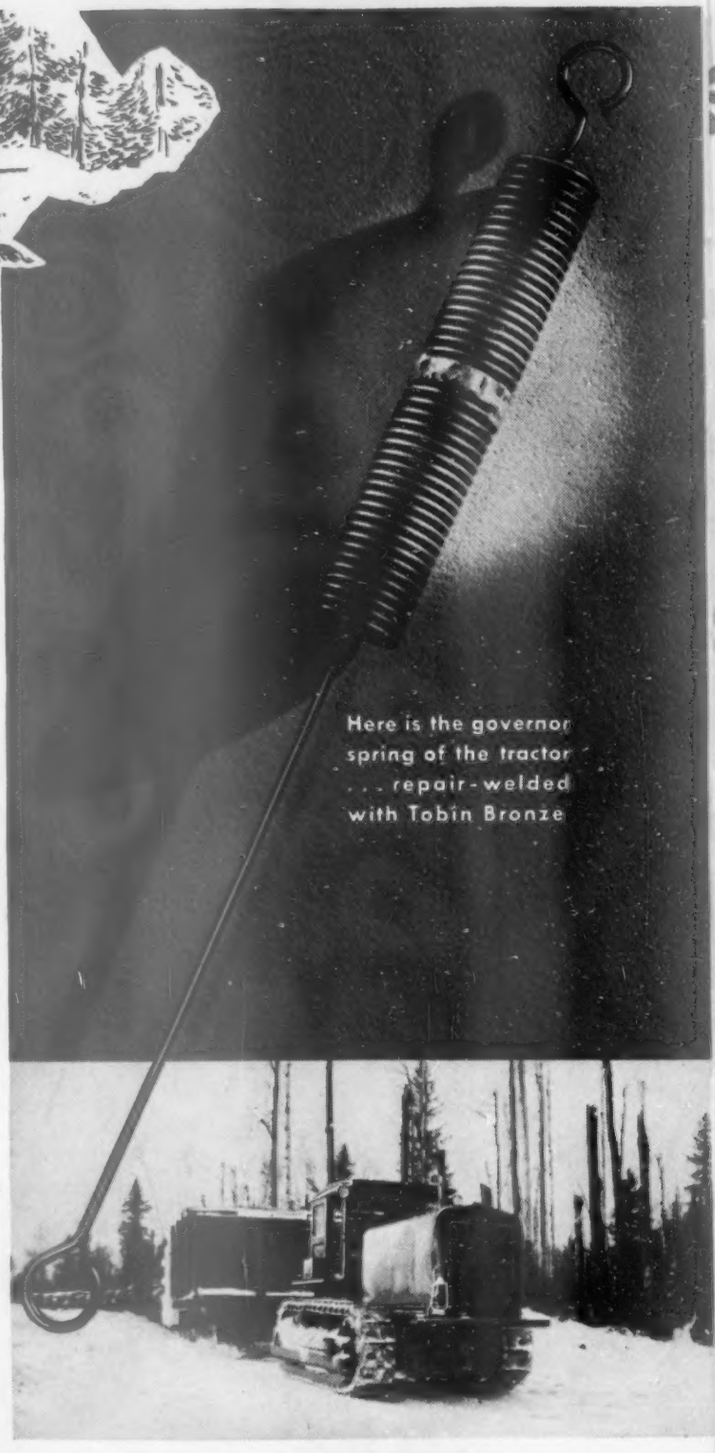
One night in January, the 75-horsepower Diesel tractor used by the Pas Lumber Company on a log haul stopped suddenly, with its big "train" of spruce logs only half-way to its destination.

Because of the intense cold, fires were started under and around the tractor . . . the usual practice with a stalled machine in the North. Examination showed that the governor spring had broken. The tractor was helpless... and the nearest point where a new spring could be obtained was *over five hundred miles* away.

A search for a spring which might be substituted proved useless. Welding was the only way out. And then . . . Tobin Bronze came to the rescue.

A metal thimble was used inside the spring to keep the parts in line while they were being joined by a collar of Tobin Bronze. The part was then replaced and the tractor continued to work splendidly until a new spring was obtained, two weeks later.

The cost of welding the governor spring with Tobin Bronze was only a few cents. Yet it prevented a tie-up of this large logging operation... saved time and money for the lumber company.



Experienced welders know the value of Tobin Bronze for difficult jobs on cast and malleable iron. Many of them depend on the uniformity and consistent high quality of this proved Anaconda Welding Rod and will use no other brand.

Tobin Bronze carries the trade-mark "Tobin Bronze Reg. U. S. Pat. Off." in each rod. Look for this trade-mark and make certain that you are getting *genuine* Tobin Bronze.

ANACONDA
from mine to consumer

Anaconda Welding Rods

THE AMERICAN BRASS COMPANY, General Offices: WATERBURY, CONNECTICUT

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letin 315 describes the Shield-Arc SAE welder, with NEMA ratings of 200, 300, 400 and 600 amperes, and gives a graphic description of the features of "dual continuous control." Both bulletins contain tables of specifications.

"Here's the Answer to Your Temperature Problem" is the title of a broadside featuring thermometer controllers for steel heating and treating and for process industries. The mercury switches used with these controls are described. Copies of this broadside may be obtained from The Brown Instrument Co., Wayne and Roberts Aves., Philadelphia, Pa.

Five hundred different applications for "Rol-Man" manganese steel are listed alphabetically in a 27-page booklet issued by the Manganese Steel Forge Co., Richmond St. and Castor Ave., Philadelphia, Pa. Characteristics and properties of this steel also are listed, and "Rol-Man" welding rod for manganese-steel welding is described.

Transformer-type a.c. welders, in four sizes, are described and their features of construction and operation enumerated in a folder issued by the Donganare Sales Co., Curtis Building, Detroit, Mich.

Metal cleaning and degreasing is discussed at length in several bulletins recently issued by the Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich.

Commercial News

Commercial Gas Co. to Hold Series of Confabs

A tour of the Dakotas and Minnesota will be made by a crew demonstrating welding, flame cutting and metal spraying during January and February, ending at Minneapolis, where the Commercial Gas Co.'s 6th annual "confab" will be held on Mar. 3 to 6. This crew will consist of men from the Commercial Gas Co., of Minneapolis, as well as factory men representing other manufacturers whose equipment is to be demonstrated.

The itinerary is as follows: Fargo, N. D., Jan. 12-15; Minot, N. D., Jan. 19-22; Bismark, N. D., Jan. 25-28; Aberdeen, S. D., Feb. 1-2; Huron, S. D., Feb. 4-6; Sioux Falls, S. D., Feb. 9-12; and Duluth, Minn., Feb. 17-20.

A program of lectures and talks will supplement demonstrations. Among the equipment that will be taken on the road will be three d.c. welders and three a.c. welders, as well as an outfit for metal spraying.

Attendance at all "confabs" will be limited to ticket holders only, and prizes totaling $2,000 in value will be given away.

Fred J. Esslinger has severed his connections with the Champion Rivet Co. of Cleveland, O., and is now acting as consultant and doing research work in matters pertaining to electric welding, with headquarters at 2580 Fenwick Road, University Heights, Cleveland, O. During his four years with the Champion company, Mr. Esslinger was engaged in electrode development work. Prior to that time he was for eight years with the Petroleum Iron Works Co., Sharon, Pa., having charge of their laboratory, weldrod department and heavy-pressure-vessel welding shop, and among his developments was an all-mineral-coated weldrod. Mr. Esslinger obtained his education at Berlin University in Germany. He came to this country in 1923, and is a naturalized citizen.

W. E. Van Dreser, manager of welding equipment sales for W. J. Holliday & Co., Indianapolis, Ind., died on Nov. 29 at the home of a son in York, Pa. He was 52 years of age and had been active in welding sales work for the past 18 years. At one time he was district manager for The Lincoln Electric Co. in Minneapolis, Minn., and later joined the Hollup Corp., first as sales agent in Minnesota and Wisconsin and later as manager of their East Coast plant and sales. Just prior to joining the Holliday organization, he was in charge of electrode sales for the Central Steel & Wire Co. of Chicago.

William Harris, a welding operator with the International Steel Co., Evansville, Ind., won the $5 prize offered by The Linde Air Products Co. at their booth at the recent Purdue University welding conference, for having guessed nearest the actual tensile pull on a weld specimen at its breaking point. The test was made at the close of the conference, and the specimen broke at 52,935.5 lb. Mr. Harris' estimate was 52,655 lb.

D. L. Mathias has joined the staff of the Metal & Thermit Corp., 120 Broadway, N. Y., as research engineer in charge of electrode research and development. Mr. Mathias graduated from the Carnegie Institute of Technology in 1914, later becoming metallurgist for the Mackintosh-Hemphill Co. He also served seven years as editor of *Heat Treating and Forging*. In 1929 he joined the Westinghouse Electric & Manufacturing Co. as metallurgist on arc-welding problems, later being engaged in developing arc-welding electrodes and processes.

The most active welding city among those visited recently by Otto Hart, president of the Hart Welding Supply Co., of Oklahoma City, Okla., was Houston, Texas, Hart reports following a recent tour of his company's stores in Texas, Louisiana and Oklahoma. The Houston branch, opened at the beginning of summer under the management of L. G. Newman, is showing a rapid build-up in the sales of supplies, particularly to oil interests. Hart took time out on the Southern coast for some fishing.

The Commercial Gas Co., 2619 Fourth St. S. E., Minneapolis, Minn., are making changes in their school to accommodate more students. Courses in both gas and arc welding are being offered. A new sand-blast room has been installed, as well as a metallizing unit, in the handling of which instruction is being offered. Classes are conducted 40 hours weekly, every week of the year. The changes made involve an expenditure of $5,000, exclusive of the cost of new equipment.

The Electric Arc Cutting & Welding Co., Newark, N. J., recently added a building of 4,000 sq. ft. to their plant. "I did not intend to put any more money into additions which might further burden me in the next depression," says C. J. Holslag, president of "Electric Arc," "but I found that I was doing business in the street, and when winter came I had to have a building." The new structure is, of course, entirely arc welded, with welded roof trusses.

The Latrobe Electric Steel Co. announces that The International Nickel Co. has just concluded a license for the United States and foreign countries to make, use and sell under the Armstrong Patents Nos. 1,997,538 and 2,044,742 for the manufacture of clad products, plates, sheets, etc., using the electrolytic iron bonding or welding method.

J. A. Krugler has been appointed general sales manager of the Taylor-Wharton Iron & Steel Co., High Bridge, N. J., succeeding J. C. Taylor, Jr., who recently resigned. For the past 12 years Mr. Krugler has served the Taylor-Wharton organization as sales engineer —for six years in the mining field, and subsequently at New York.

The Silver Seal Laboratories of Wichita, Kan., and Tyler, Tex., manufacturers of Silver Seal welding fluxes, have been appointed by the Torchweld Equipment Co., Chicago, as distributors of their products in the South and Southwest. W. L. Loudy is president of the Silver Seal organization and E. F. Dieffenbach is secretary-treasurer.

At the annual meeting of The National Oxygen & Acetylene Association held in St. Louis on Nov. 17, all directors and officers were reelected. The meeting also approved of the removal of the office of the Association from Chicago to Columbus, Ohio.

The Schoop pistol for spraying molten metal is being distributed by Louis LeVier, 413 N. Delaware St., Indianapolis, Ind. This product is manufactured by Société Nouvelle de Métallisation, Paris, France.

The Fibre-Metal Products Co., Chester, Pa., have completed an addition, 150 x 50 ft., of steel and concrete construction adjoining their present building, in order to provide more manufacturing space.

The Corpus Christi (Tex.) Oxygen Co. has come up with the boom of that town, building an oxygen plant. They are also stocking and selling "Lincoln" welders and electrodes as jobbers for the Big Three Welding Equipment Co., of Houston.

Portable welding units and tractor-type crawlers used on excavating equipment will be displayed by the Harnischfeger Corp., Milwaukee, Wis., at the road show in New Orleans, La., Jan. 11 to 15.

Arcos, Inc., Philadelphia, Pa., have appointed the Machinery & Welder Corp., with offices in St. Louis, Chicago, Moline, Milwaukee and Kansas City, as distributors of their line of electrodes.

Roy Peterson, of Chicago, who has had long service as a welder, has been employed by the Torchweld Equipment Co., 1035 W. Lake St., Chicago, as sales and service man.

Arcos, Inc., Philadelphia, Pa., have appointed C. E. Phillips & Co., of Detroit, to be their distributors for the state of Michigan.

Notes From the Field

Because of a healthy increase in business and the installation of new machinery making additional floor space imperative, the Federal Machine & Tool Co. recently took over a building adjoining their plant at 4480 Hunt Ave., St. Louis, Mo. This company, which last year purchased the Nelson Forge & Angle Bending Co., of St. Louis, is engaged primarily in angle bending and ornamental-iron scroll work, but does considerable welding repair work. A portable arc-welding machine installed a few months ago was productive of enough profit to pay for itself in three weeks, it is reported. Just now, with cold weather around the corner, the firm is looking forward to a repetition of the business they did last winter thawing out frozen water pipes with their welding machines.

The unusual demand for welded floating equipment for use on inland waterway transportation in the Pittsburgh harbor may be realized from recently released Government statistics. An all-time record was established on the Monongahela River during the month of October, when 2,661,398 tons of freight was carried on that stream. The previous record was made during August when 2,622,723 tons was reported. At the same time another record was established on the Allegheny River during October, when 427,897 tons was moved on that stream, an increase of 22,455 tons over the tonnage reported in July, the heaviest month on that stream this year. The amount of tonnage that passed through Dashields twin locks during October was 1,203,939 tons.

What was thought to be a very small job, turned out to be a much larger one, at the Commercial Solvents Corp., in Peoria, Ill. A large riveted 50-ton coal hopper located under the railroad tracks, with a large conveyor at the bottom to carry coal to the bunkers in the boiler room, needed to be rebuilt without interfering with operation. One section at a time is being removed and immediately replaced by temporarily welding a sheet in place. About 18 sections will be removed, replaced and tack welded. On completing this temporary work, the hopper, which is of 5/16-in. boiler plate, will be welded to make it water tight. The welding is being done by The Superior Welding Co., 331 Knoxville, Peoria, Ill.

After a recent breakdown on a dredge in the Buffalo harbor, Roger J. Sweet, welder of 1189 Niagara St., Buffalo, was called to remedy the trouble, due to a cracked steam cylinder. One of the cables had caught a bucket and pulled the engine frame out of line. Twenty 1¾-in. bolts were shifted out of position. A force of twenty tons would have been necessary to hoist the engine, repair it, and replace it, but Mr. Sweet repaired the machine on the dredge without moving it, and saved about a week's time.

A large fleet of floating equipment now under construction at various boat yards in the Pittsburgh area is being

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Ryerson White Flux Coated
Ryerson High Carbon White Flux Coated
Ryerson Blue Flux Coated
Ryerson 3½% Nickel Steel Flux Coated
Ryerson High Manganese Steel
Ryerson Hard Surfacing
Ryerson Allegheny Stainless Flux Coated
Ryerson Allegheny Stainless No. 44

GAS RODS

Ryerson Copper Coated No. 206
Ryerson Copper Coated No. 210
Ryerson Cast Iron
Ryerson 3½% Nickel Steel
Ryerson Tobin Bronze
Ryerson High Carbon Bare No. 2110
Ryerson Allegheny Stainless Bare
Ryerson Hard Filler

JOSEPH T. RYERSON & SON, INC.

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fabricated under the supervision of the inspection department of the U. S. Engineers of the Pittsburgh area. These consist of 24 pontoons being built by the Treadwell Construction Co. at Midland, Pa., for the U. S. Engineers at St. Paul, and two dump scows for the U. S. Engineers at Louisville, now under construction in the Ambridge plant of the American Bridge Co. Final inspection has been made on roller and tainter gates, service bridges and operating machinery in the plant of the Treadwell Construction Co. for installation at dam No. 8 on the Mississippi River.

The American Institute of Steel Construction announces that Mace H. Bell, formerly with the U. S. Engineers office at Zanesville, O., has been appointed district engineer for the Institute to cover the Southwestern territory, with headquarters at New Orleans. Robert J. Wood has resigned from the Institute staff to take a position with the Mississippi Valley Structural Steel Co., which has necessitated some changes in the territories of the district engineers. As a result, L. H. Dodd has moved from Dallas to take over the St. Louis office, and Mr. Wood's territory has been extended to include Louisiana, Texas and New Mexico.

Representatives of Pittsburgh boat- and barge-building concerns attended the annual convention of the Mississippi Valley Association, which was held in St. Louis, Nov. 24. According to gossip at the convention, it was intimated that continued improvement of rivers and the building of locks and dams, are causing a further demand for the movement of freight by river. According to unconfirmed reports there will be an inquiry soon for a fleet of 39 standard-size coal barges, requiring approximately 6,000 tons of steel plates and shapes. With the trend unmistakably toward welded construction, this is very encouraging to the large fabricators of welded equipment.

A portable arc-welding unit consisting of a 6-cylinder Plymouth motor, mounted on a Ford chassis, with a Ford tank and a Cadillac radiator is in use by Paul A. Dunn Sons, 2207 Elmwood Ave., Buffalo, N. Y. The rig has floating power and free wheeling, which prevent the generator from backing up in case of a motor backfire. The Dunn company does work for over 40 automobile dealers in Buffalo, specializing in crankcase jobs. Recently a 1932 Lincoln 12 was converted from a 5-passenger sedan into a hearse. The company also manufactures auto conveyors capable of carrying three or four cars for local forwarding companies.

The Jones & Laughlin Steel Corp., Pittsburgh, Pa., expects to begin construction of a fleet of steel barges at its Southside plant early in February for use in the local steel- and coal-moving trade. The fleet will consist of 15 barges, each 200 ft. long, to be constructed for the Vesta Coal Co., its coal-carrying subsidiary, and 10 barges which will be built for its own use. The latter will be 153 ft. long, while all will have the same width of 26 ft. and a depth of 11 ft. All these barges will be of the welded type. Work will be started first on the small barges and delivery will be made at the rate of three a month.

Boat and barge builders in the Pittsburgh district are now receiving inquiries for the construction of tank and coal barges for spring delivery. Among the latest inquiries received is that of the Socony-Vacuum Oil Co., Inc., for the construction of a tank barge for use on the Ohio and Mississippi Rivers. This barge is to be 195 ft. long, 35 ft. wide and 10 ft. deep, and will have a capacity of 8,000 barrels. Approximately 235 tons of steel plates and shapes will be required in the construction. It was reported in barge circles that this order, when let, may be increased by three additional carriers.

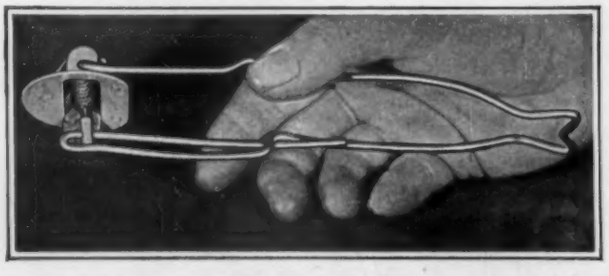
Colonel John F. Conklin, in charge of the U. S. Army Engineers District, Huntington, W. Va., will open bids Dec. 21 for additional river equipment to be delivered to the vicinity of the Gallipolis roller top dam, Ohio River. This includes a 35-ton whirler derrick-boat, 110 ft. long, 52 ft. wide and 8 ft. deep, with watertight bulkheads. It is to be equipped with two booms, one 125 ft. long and the other 155 ft. long. Included also is one welded barge of wrought iron, probably the first to be built in recent years; it will be 151 ft. long, 46 ft. wide and 7.6 ft. deep.

Considerable repair work for cotton gins is being done by the Memphis Welding Co., Fourth St. and Jefferson Ave., Memphis, Tenn. This shop is frequently called on to repair broken hydraulic cotton press cylinders, which are heavy and expensive parts. George E. Mitchell, manager, keeps a cylinder in good repair in the shop to trade to any gin breaking its press cylinder, thus permitting the gin to install a repaired cylinder with the minimum delay. Time is a real factor to cotton gins during the cotton season when they are running 24 hours a day.

In California the welding industry is benefiting materially in auto-trailer-coach construction work, the trailer industry having become a major business in that area. A trailer-coach association, recently organized, states that 60 concerns are in this business in the Los Angeles territory, 35 of whom have nation-wide distribution of their products. More than 3,000 units have been built since Jan. 1, with a total value of more than $1,500,000. Many of the frames and bodies of these auto coach trailers are of all-welded steel construction.

A 9-in. crankshaft of a 180-hp. Diesel engine was recently welded by the Milton Bowers Welding Co., 346 Madison Ave., Memphis, Tenn. As a result of an accident, the crankshaft was broken in the "throw," and the shaft was bent slightly. To straighten, arc weld, build up and re-machine the shaft required 42

The Improved "Round File" Gas Lighter



Many superior design and construction features, found only in Improved "Round File," make this lighter the Welder's Favorite.

Hood forms a pocket for gas, insuring immediate ignition.
Larger file area, providing longer life for lighter.
Larger spark metal, which assures many additional ignitions.
Locking slip-on renewal cartridge, permits immediate replacement.
Cadmium plated, preventing rust.
Every part **thoroughly tested.**
Fully guaranteed.

Write for descriptive circulars and prices.

CAUTION: Imitations of the patented Improved "Round File" are on the market. For your protection insist on Safety Gas Lighter Co. patented lighters and genuine Safety Gas Lighter Co. renewals.

ORIGINATORS OF THE HAND GAS LIGHTERS **SAFETY GAS LIGHTER CO.** Est. 1901 **LYNN, MASS.**

hours continuous work. The engine, used in a local brick-manufacturing plant, was out of service a total of only three days. The cost of repairs was considerably less than one-third the cost of a new crankshaft.

The Service Welding Co., 3216 Morgan Ave., St. Louis, Mo., recently repaired a break across the throat of a huge five-ton punch press at the Schleuter Manufacturing Co., St. Louis. The broken press was taken to the welding shop, where three operators, using 240 lb. of cast-iron rod, made a weld 18 in. thick and 24 in. wide, completing the job in 24 hours. J. Smith, proprietor of the Service Welding Co., estimates the Schleuter company saved approximately $4,500 over the cost of a new casting.

The Clarksburg (W. Va.) Water Board has a municipal project under way which will require a large quantity of welded steel pipe and welded steel tanks. Bids are being asked on 1,300 lineal feet of 24-in.-o.d. steel pipe, ½ in. thick, and 1,100 ft. of 20-in.o.d. steel pipe, ½ in. thick, all of which is to be electrically welded. The expansion program also calls for three-all-welded steel tanks. These will be 56 ft. in diameter and 28 ft. 6 in. high.

Several contracts recently let for pipelines, to be oxyacetylene welded, have been reported by The Linde Air Products Co., New York City, as follows: Pipeline between Jackson and Vicksburg, Miss., 44 miles long, consisting of 6⅝-in. pipe. Contract awarded by Cosden Pipe Line Co., of Tulsa, to Sheehan Pipe Line Construction Co., also of Tulsa, 22 miles long, from Wewoka south to Fitts pool, Fittstown, Okla., to consist of 4-in. pipe.

An all-welded factory addition of 16,000 sq. ft., containing 4,400 sq. ft. of glass, is under construction by the Hobbs Manufacturing Co., trailer manufacturers, at their plant at 609 N. Main, Fort Worth, Tex. The added investment in building and equipment will approximate $25,000. At present 75 men are on the Hobbs payroll, and this number will be greatly augmented upon occupancy of the new building.

Frank P. McKibben, past president of the American Welding Society and a noted bridge engineer, died at his home, near Fayetteville, Pa., on Nov. 27, at the age of 65 years. He was a former teacher at Massachusetts Institute of Technology, Lehigh University and Union College, served as city engineer of Schenectady, N. Y., in 1924 and 1925, and later was a consulting engineer with the General Electric Co.

"Shot welding" will be used in the construction of six light-weight, stainless-steel passenger trains for the Chicago, Rock Island & Pacific Railroad. These will be used on daytime runs out of Chicago. The order comprises four 3-car trains and two 4-car trains, and each will be partly articulated. The trains will be built by the Edward G. Budd Manufacturing Co., Philadelphia, Pa.

The new White Eagle gasoline pipeline, 178 miles in length, extending from the White Eagle refinery at Augusta, Kan., to Kansas City, Kan., is now in operation. The Kansas City terminal is now completed, but is will be after the first of the year before the Topeka terminal is put in operation. This $1,500,000 pipeline and terminal project used welding from start to finish.

A contract has been awarded the Consolidated Steel Corp., of Los Angeles, Calif., by the U. S. Engineers office in Los Angeles for 1,897,000 lb. of fabricated steel and other metal work, much of which is to be welded. The work includes the framework for the Pacific Avenue Bridge and several other bridge superstructures.

Some very rigid boiler laws have recently been imposed on the Oklahoma boiler and welding shops. Electric-welded tips on flues is no longer allowed unless every other flue is replaced by a new one, though flues can be tipped by forge welding, which is almost a forgotten art in that region. Also, caulk welding is not allowed on the edges of rivets, it is reported.

The Canyon Boiler & Welding Works, operated by Raymond Sullivan, is a new addition to the oil play around Haven, Kan. Mr. Sullivan has a good reputation as a boilermaker and welder. His complete new outfit, including a 300-ampere gasoline-engine welder and acetylene equipment, enables him to give good service to the oil trade around Haven and Burrton.

Construction of a fleet of 10 welded steel barges in the barge yards of the Jones & Laughlin Steel Corp. is progressing to such an extent that eight of these have been launched and the first of these already are in use moving steel from the Aliquippa plant to Memphis. The last two of the consignment will be finished at an early date.

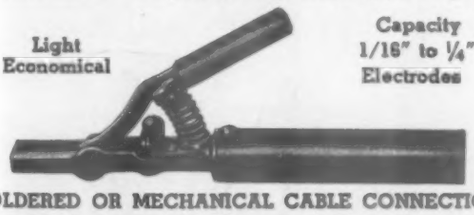
The Cities Service Co. are building a new gas-compressor station northwest of Wellington, Kan., which will boost natural gas from the wells in that area through a new 4-mile lateral pipeline to the main pipeline running from Oklahoma City to Topeka and Kansas City. Completion of this project is scheduled for Jan. 1.

Progress is being made by the Cities Service Co. on their new natural-gasoline plant in the Stone sector of the Burrton oil pool of Reno County, north of Haven, Kan. A considerable amount of welding is required on this $350,000 project.

Peter Schweitzer, proprietor of the Schweitzer Welding Co., 2nd St. and

Welders Prefer these Practical Electrode Holders

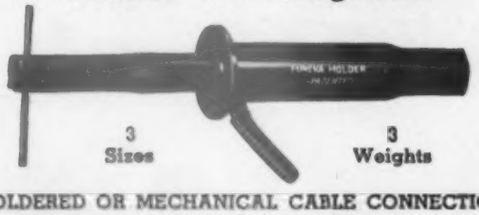
"SIMPLEX" Improved Spring-Type Holder



SOLDERED OR MECHANICAL CABLE CONNECTION

Jaws made from copper alloy with 96% copper content, grooved to hold electrode at various angles. Spring entirely insulated. Efficient clamp eliminates removing of fibre handle when making mechanical cable connection.

"EUREKA" the Leading Holder



SOLDERED OR MECHANICAL CABLE CONNECTION

Jaws as well as all other parts easily replaceable at low cost. Cool grip assured by complete circulation of air through fibre handle at all times.

A Trial Will Convince **Jobbers in All Principal Cities**

THE FIBRE-METAL PRODUCTS CO. *Pioneers, Designers and Manufacturers* Chester, Penna.

Broadway, Cincinnati, O., died recently. Schweitzer, who was 49 and resided in Newport, Ky., is survived by his widow, Mrs. Mary Anna Schweitzer, and two brothers and a sister. He operated one of the leading welding concerns in this territory in the Schweitzer Welding Co.

Jack Farley, well-known Kansas oilfield machine and welding-shop operator of Arkansas City, Kan., passed away in Topeka, Kan., Dec. 8, following a tragic automobile accident south of that city in which six people were killed. His death is mourned by many, including a large loyal organization that operates his four shops.

Fred Weathers, for more than 10 years a welding operator with the Western Welding & Boiler Repairing Co., 1432 W. Lake St., Chicago, Ill., died on Oct. 11. Though handicapped many years ago by the loss of a leg, Mr. Weathers remained at his trade and attained high proficiency.

The Smith School of Welding, 250 West 54th St., New York, N. Y., have installed a new arc welder and added a number of new oxyacetylene outfits to their equipment. The school quarters have been enlarged to 1,500 sq. ft. and a large increase in the number of students is reported.

M. L. Rogers, of the Petroleum Machine Co., Seminole, Okla., who employ a corps of welders, reports a good year for 1936, with good prospects for 1937, since there is to be quite an extensive drilling campaign in that section during the next year.

The Gay Engineering Co., Los Angeles, Calif., has begun work on its new factory building at the corner of 11th and Soto Sts. The concern employs many welders in its plant, the present location of which is 2650 Santa Fe Ave.

Marion Adams, formerly with the WAK Welding & Machine Shop, Hutchinson, Kan., will open his own shop Jan. 1 in Lyons, Kan. The new shop will cater to oilfield welding and general machine work.

J. A. Jones, formerly with the Iowa Electric Welding Co., of Cedar Rapids, has purchased the Commercial Welding Shop, at Earlville, Iowa. He has new equipment and is specializing in contract welding.

The new Cunard-White Star Liner *No. 552,* whose keel was laid in November on the River Clyde, Scotland, will contain more electric welding than was employed in the *Queen Mary.*

Adding to the swelling tide of welding work in the Middle West, the Del Rey Gasoline Co. is constructing a 35,000,000-cu. ft. gasoline plant in the Britton area of Oklahoma County, Okla.

C. F. Braun & Co., of Alhambra, Calif., large manufacturers of all-welded oil refinery and gasoline-plant equipment, is adding an extension to the north end of their main plant.

The Omaha Steel Works, Omaha, Nebr., is just completing a 180-ton order of hand-guard railing. The entire welding on this job was done by the shielded-arc process.

The Ames Welding Co., Ithaca, N. Y., recently completed a job on the new postoffice in Ithaca, which required 578 welds.

James Parker has opened a welding shop at 90 S. Main St., in Batavia, N. Y.

MR. WELDER! WHAT ABOUT YOUR RODS?

DON'T take chances with untried welding rods! Unless the rod you use is exactly what is needed for the job, your work will not be well done.

Regardless of the *process* you use, we have a rod for the job.

Regardless of the *material* to be welded, we have a rod for the job.

Regardless of the *type of work* to be done, we have a rod for the job.

And our assurance as to the quality of these rods and their performance on the job is not based merely on opinion.

Our own research department tries and tests all rods offered by us. When we recommend a rod, our recommendation is based on *what we know from personal experience.*

Just "a rod" won't do when your task demands exceptional results. Then you must have "*the* rod."

So don't take chances with untried material when you can find in our warehouses the most comprehensive supply of tested welding materials assembled anywhere.

Send today for our catalog, and call on our experts for any technical aid you may wish.

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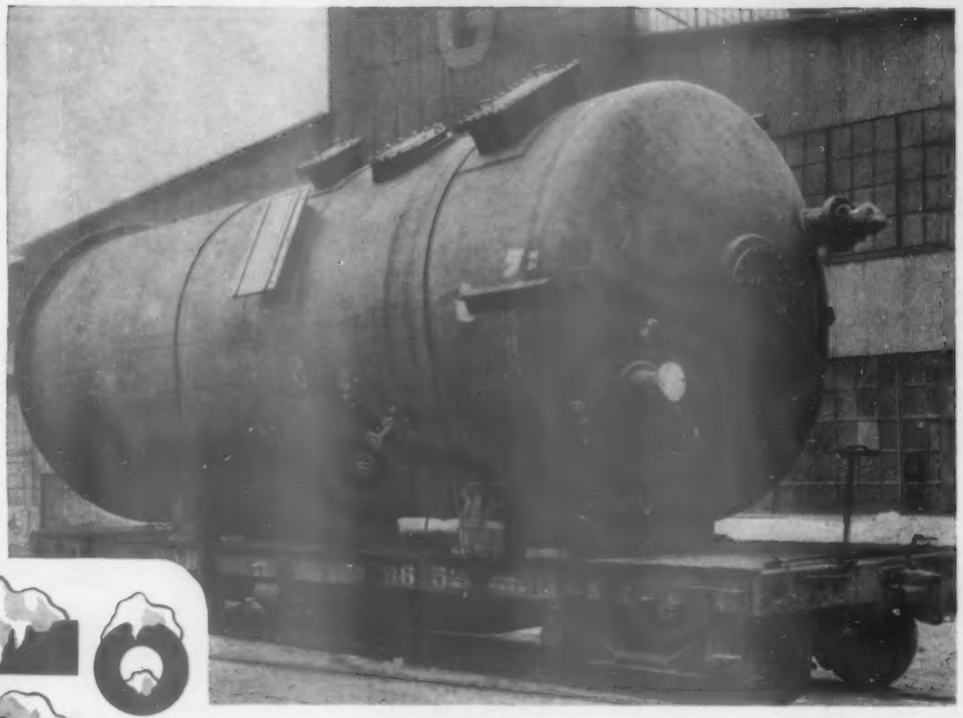
"A Rod for Every Job in Gas and Electric Welding, including Sil-Fos, Easy-Flo and Silver Solders."

Photo courtesy San Shipbuilding & Dry Dock Company



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75° BELOW ZERO

THE WELDS IN THIS WAX FILTER CAN TAKE IT

The fabrication of wax filters for petroleum refineries calls for exceptional welding. Such equipment operates under high pressures and intense cold. Welds must be sound and have unusual resistance to shock at very low temperatures.

By depositing a metal showing Charpy impact values of 20 to 24 ft. lbs. at —75° F., Murex Nickel Steel Electrodes meet the requirements fully.

The Murex line includes electrodes for high speed, downhand welding of mild steel; for three position and horizontal fillet welding; for welding manganese, stainless carbon-molybdenum, Cor Ten, Mayari, Cromansil, copper-bearing, high carbon, and nickel steels; and, for building up and hard surfacing plain carbon steels. All are standard Murex Electrodes that can be furnished promptly from stock . . . and, all possess the well known Murex ability to provide highest quality weld metal at lowest cost.

A comprehensive booklet gives complete data on the chemical analysis and physical properties of the metal deposited by each electrode in the Murex line. Write for Booklet 2.

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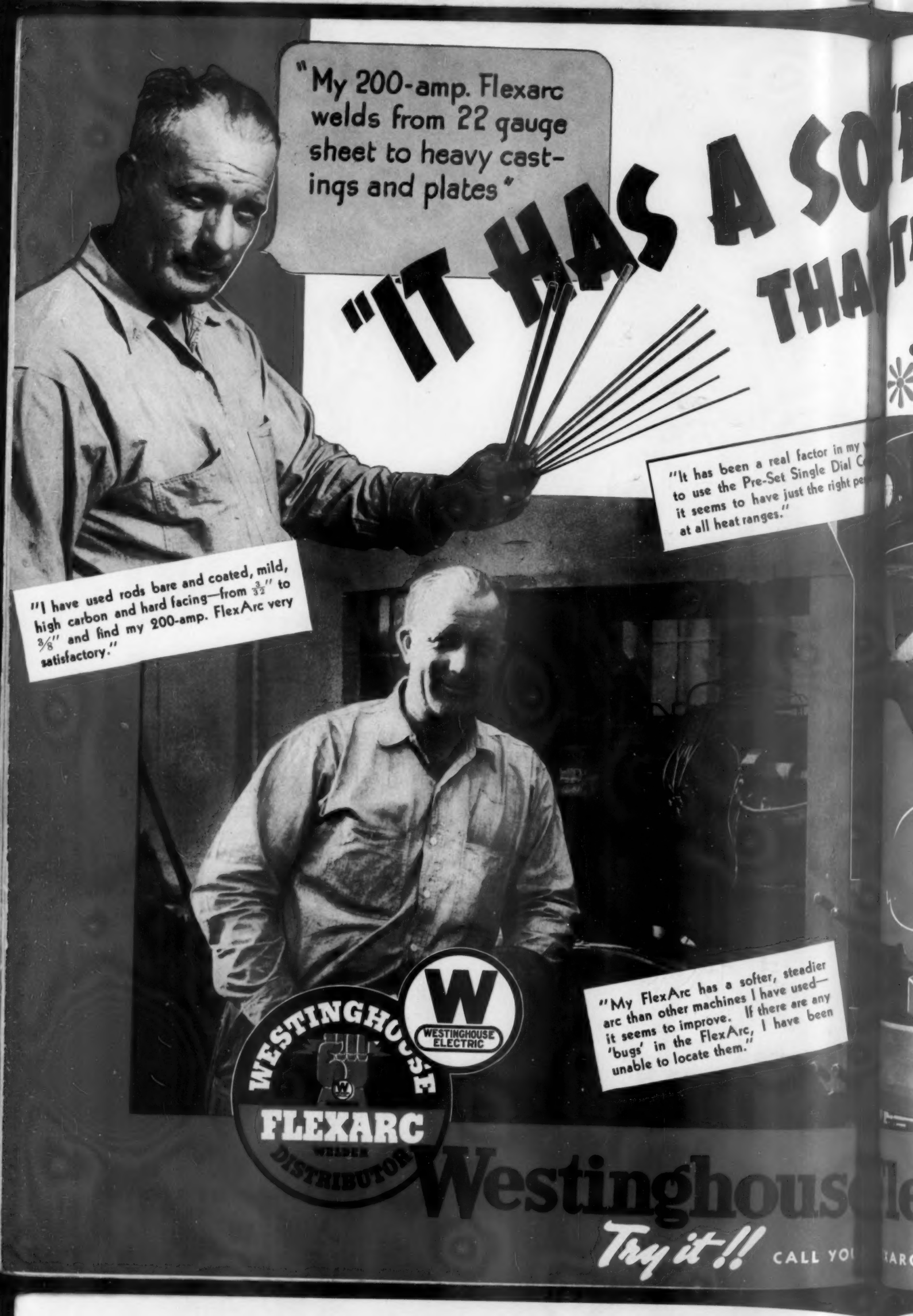
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to use the Pre-Set Single Dial C
it seems to have just the right pe
at all heat ranges."
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Try it!!
CALL YO

ER, STEADIER ARC THER MACHINES I'VE USED"

Says C.W. WELLS, HOLLYWOOD, CALIF.

TYPICAL OF HUNDREDS OF STATEMENTS FROM NATION-WIDE POLL AMONG FLEXARC USERS.

MR. WELLS has spent years doing all kinds of welding—with practically all makes of machines. He knows the importance of Arc Stability, Single Dial Control, Safety, Speed, Economy, and above all, freedom from such gadgets as meters, reactors, exciters, etc.

That's why he and other experienced welders all over the country are so well pleased with the New FlexArc . . . why the FlexArc is the overwhelming choice of operators who have tried it.

Try the New FlexArc! Prove to your own satisfaction that it has all you want and more. Visit your Westinghouse Welding Distributor. He'll be glad to place a machine at your disposal. Mail the coupon for further information.

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Send THIS COUPON for information on the New FlexArc . . . America's Fastest Selling Welder!

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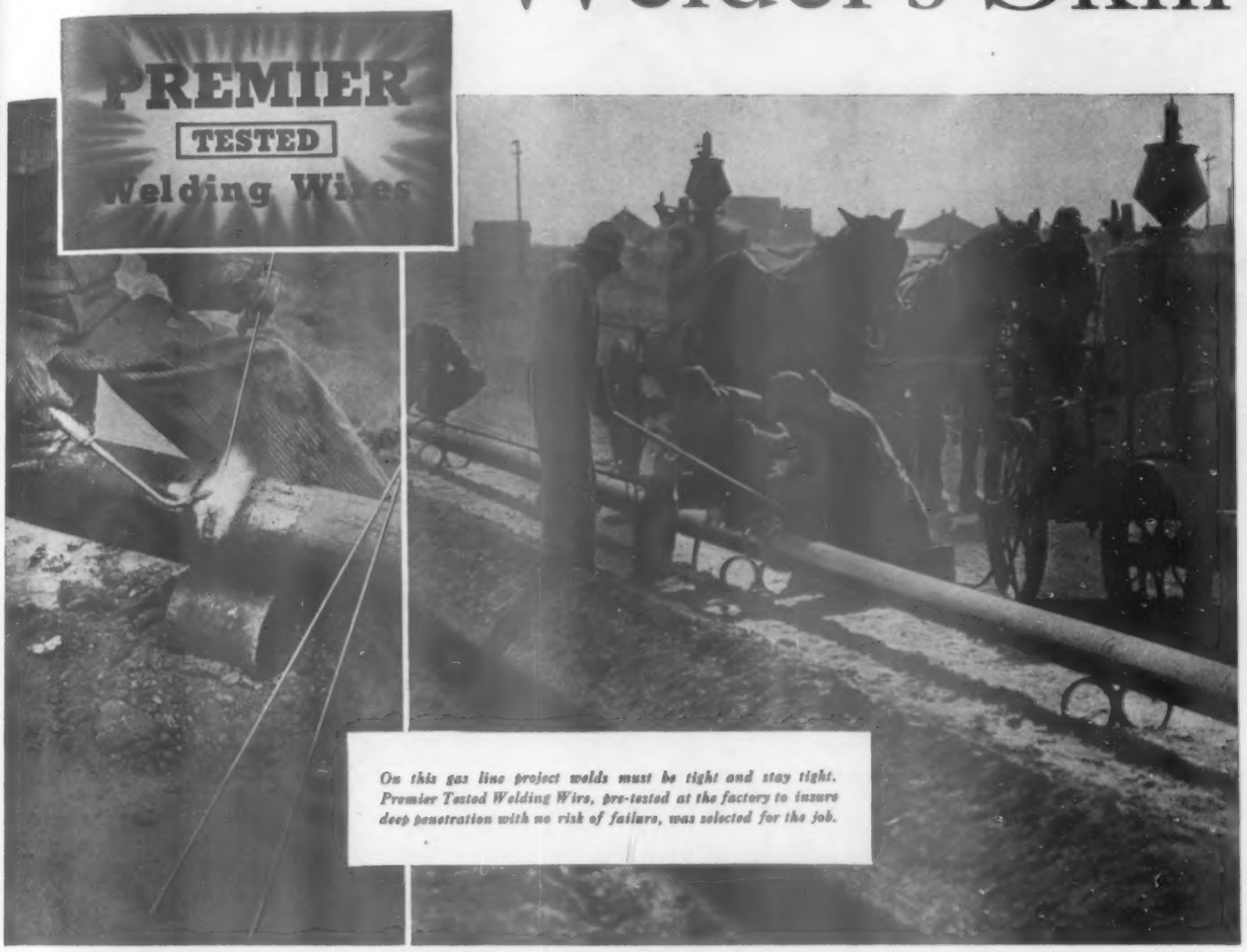
THE PITTSBURGH GENERATOR CO., McKEESPORT, PENNSYLVANIA

HAPPY
NEW YEAR

Back of the Welder's Skill



On this gas line project welds must be tight and stay tight. Premier Tested Welding Wire, pre-tested at the factory to insure deep penetration with no risk of failure, was selected for the job.

PUT yourself in the welder's place. You expect him to turn out a perfect weld. Faulty welds hinder production, increase your labor costs. He's skillful, experienced. But that's not enough. You, the man who buys his materials, are the one person who can give his craftsmanship full play.

Because it is shop-tested during manufacture and re-tested before shipment, Premier Tested Welding Wire assures this maximum utilization of the welder's skill. Every bundle is checked to make certain that you get welding wire that is free-flowing, deeply penetrating, free from impurities and excessive sputtering, uniform in quality.

Write today for the Premier Welder's Handbook—a condensed manual on welding practice full of helpful information on approved methods for electric and gas welding, along with suggestions for the selection of electrodes and welding rods. It tells you of the many grades of Premier Tested Welding Wire on hand to meet your demands. A postal card brings this new hand-book to you.

Amerclad All-Rubber Welding Cables are tough, safe, non-kinking and highly flexible. Manufactured in strict accordance with latest I P C E A specifications for Arc Welding Cable.

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UNITED STATES STEEL

TIRED OF GETTING WRONG NUMBERS?

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No. 1-2-3-6 or 10 and get "connected with the complete line of Colmonoy 'Easy-to-Apply' Products."

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Adapted to a cast-on process for centrifugal pump sleeves, pump rods, packing glands and similar products. Can also be utilized as a welding rod, or welding electrode, to weld on a deposit which protects the surface from extreme corrosion as well as abrasion.

• COLMONOY NO. 3

This cast rod has a combination of properties that shows exceptional resistance to shock as well as abrasion and possesses considerable red hardness. It is suitable for tipping metal-cutting tools and its deposit runs to a hardness of 64 or more on the Rockwell C Scale—627 Brinell. Can be applied with either the oxy-acetylene torch or the electric arc.

• COLMONOY NO. 2

Provides a super abrasive-resistant surface on ferrous metals, at a relatively low cost. Furnished for application with the oxy-acetylene torch, or electric arc, with a resultant deposit that is 58 Rockwell C Scale—545 Brinell hard.

• COLMONOY NO. 1

A particularly economical rod where a tough, hard, thick deposit is required. Consists of a high carbon steel core and a flux mantle made up of Colmonoy crystals and other substances. Unequaled for building up relatively large sections or thick overlays. Deposit has a hardness of 60 or more Rockwell C Scale, 614 or more Brinell.

• COLMONOY NO. 10

This rod is cast from an alloy of 10% Colmonoy No. 6 in ingot form, and 90% copper, and is extremely resistant to boiling, dilute sulphuric acid. Can be used as a welding rod or cast into intricate shapes that are free from porosity and easily machined.

• COLMONOY SWEAT-ON

These crystals, made into a paste with water glass and water, are easily applied to ferrous metals with the oxy-acetylene torch, the carbon electric arc, or by furnace heat. The resultant overlay, or metal preparation is highly wear resistant, corrosion-resistant, and heat-resistant. It is economical as well as highly efficient.

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NOW—for the first time—the right TYPE and SIZE of arc to suit every job . . . every time
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. . . both
TINY ARC
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DEPOSITING ARC
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A book, replete with illustrations, has been carefully compiled to give you the facts you should know to be abreast of this welding advancement. By all means YOU SHOULD HAVE THIS BOOK! The coupon will bring you a free copy without delay. THE LINCOLN ELECTRIC COMPANY, Dept. CC-323, Cleveland, Ohio. Largest Manufacturers of Arc Welding Equipment in the World.

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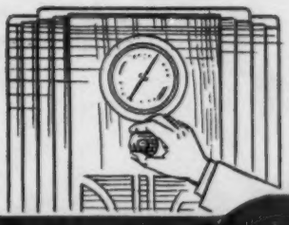

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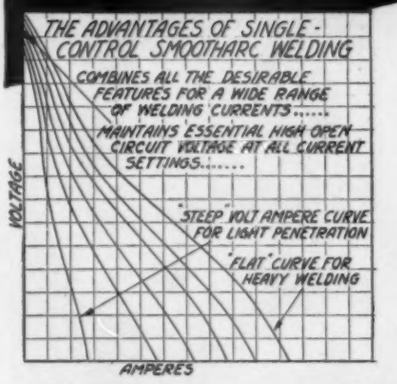
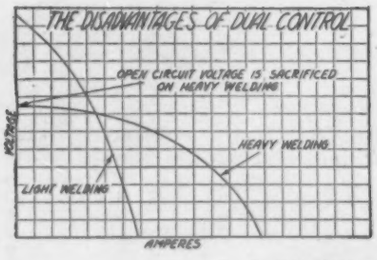
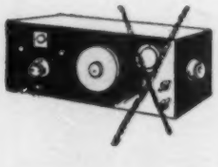

THE ADVANTAGES OF SINGLE-CONTROL SMOOTHARC WELDING
COMBINES ALL THE DESIRABLE FEATURES FOR A WIDE RANGE OF WELDING CURRENTS.....
MAINTAINS ESSENTIAL HIGH OPEN CIRCUIT VOLTAGE AT ALL CURRENT SETTINGS.....
"STEEP" VOLT AMPERE CURVE FOR LIGHT PENETRATION
"FLAT" CURVE FOR HEAVY WELDING
VOLTAGE
AMPERES

VOLT AMPERE CURVE OF SMOOTHARC WELDER

Proper and regulated excitation voltage for each current setting is automatic in the Smootharc Welder through shifting exciter brushes with welding current carrying brushes . . . all achieved by the Smootharc perfected single current control system.

Provides "steep" voltage curve for light welding, indicating light penetration for light gauge welding, preventing the arc from blowing through the sheets. "Flat" curve for heavy welding, indicating high reserve heat capacity in the arc for heavy difficult welds. Note that high open circuit voltage is maintained at all settings.





Two difficult manual adjustments—welding current and open circuit voltage—are required by multiple and dual control welders.

Single, automatic current control which provides easier, faster and superior welding is a patented, exclusive feature of Smootharc Welders. . . . The current setting, shown by a clear reading indicator, is automatically and positively maintained by the Smootharc generator under continuous duty—without further attention by the operator or the manipulation of complicated dual control devices. . . . Only Smootharc Welders have this patented feature of Single Current Control. Investigate and test this outstanding feature. Send for bulletin giving complete information.

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In general, this unusual alloy will give complete satisfaction in any application calling for a metal combining the structural strength of steel with the corrosion resistance of copper. In the process industries, especially, Herculoy has been found highly successful—withstanding conditions involving severe mechanical strain and chemical attack.

Herculoy can be welded by most of the standard methods including carbon arc, automatic metallic arc, oxy-acetylene and resistance welding. Herculoy Welding Rod is especially recommended for welding Herculoy. This welding rod can also be used to good advantage for welding copper, malleable iron and steel.

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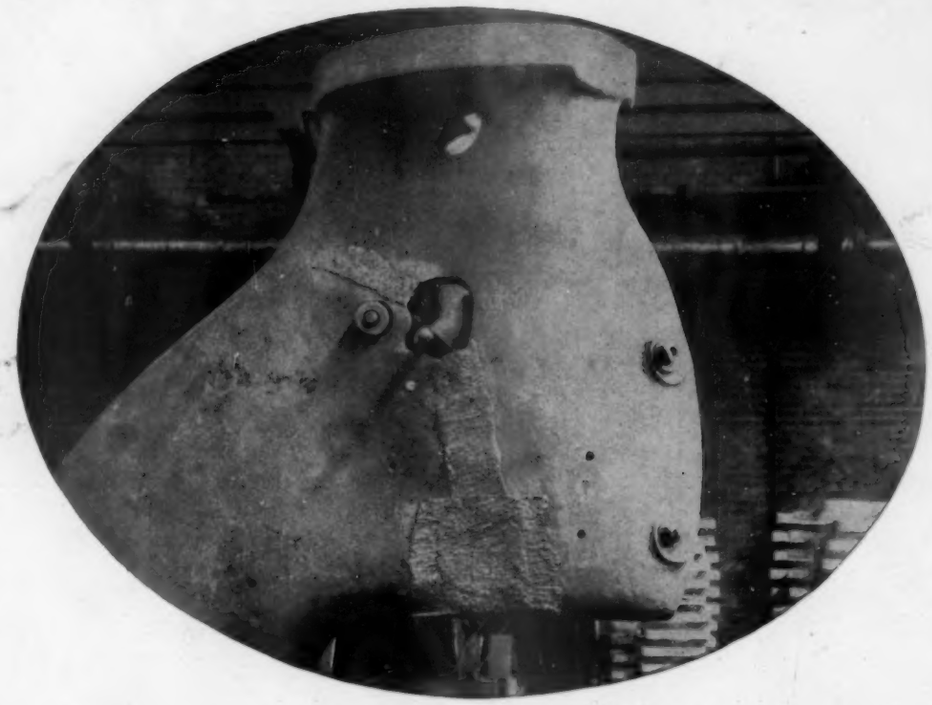
Cast Iron—
Weld It With UNA 425



UNA 425 — A new, moisture-resistant, heavily coated rod, developed especially for Cast Iron Welding

THIS new UNA rod, placed on the market about four months ago, has met the enthusiastic approval of all welders who have used it.

It consists of a suitable base rod with a moisture-resistant, shielded arc coating.

The fluxing action of the coating is such that the deposited metal readily unites with the cast iron and the metal is dense.

The penetrative power of the arc is light so that carbon pick-up from the parent metal is minimized.

Light members can be welded without studs. Heavy members should be studded.

The slag is light and easily removed.

Can be used with D. C. or A. C. welding current.

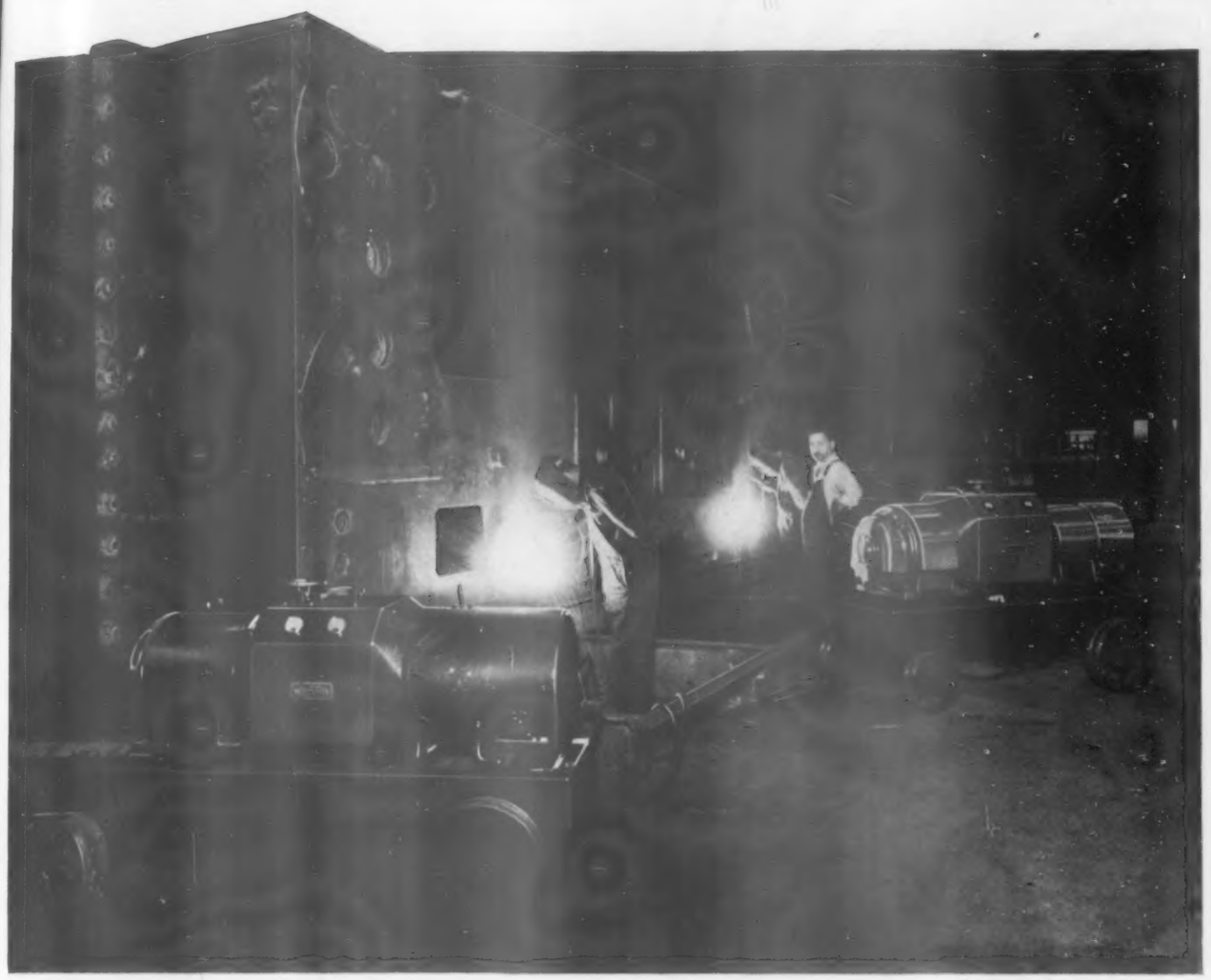
Available in one size only, namely, 1/8 in. x 14 in.

Try a sample of this new rod. Just ask for a sample of UNA 425. A liberal sample with a detailed instruction sheet will reach you promptly.

UNA Welding, Inc.

Dept. A, Cleveland, Ohio

Manufacturers of Una Welding Rods and Automatic Equipment
Plants at Cleveland, Ohio, Monessen, Pa., and Houston, Texas
In Canada — Frost Una Welding Co., Ltd., Hamilton, Ontario



A Huge Job — all the welding of parts on this job was done with WILSON ARC WELDERS

This huge Actuator Base—measuring 23 ft. x 9½ ft. x 4 ft.—was fabricated by the Lakeside Bridge Co. of Milwaukee for use on Bonneville Dam in Oregon. Steel thickness: bottom and partition plates, ⅝"; sides, ½"; top plates and pads, ⅞". Connecting the various compartments to openings in the top is a system of over 180 lineal feet of 3" to 12" pipe—all welded—which showed not a single leak when tested at double its normal working pressure at 300 lbs. per sq. in.

The Lakeside Bridge Co., like so many other concerns doing electric arc welding, has standardized on WILSON WELDERS—"the machines that make the arc behave." It is this inherent ability of WILSON WELDERS to establish and maintain a stable, uniform, heat-generating arc, that makes arc welding easier to perform and brings down its cost.

Write for the WILSON WELDER Bulletin which contains full details, including types and capacities.

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& METALS COMPANY

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These A.W. S. Codes, Standards and Specifications Are For You!

NO achievement of the AMERICAN WELDING SOCIETY has a greater practical value to the welding field than the formulation of the codes, standards and specifications which this organization has given to industry. They have lowered costs, increased welding efficiency, simplified design, assured safety and advanced the whole art of welding in a manner possible by no other means. This material, part of which is listed below, has been prepared *for you.* Avail yourself of it now!

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Tentative Rules for the Fusion Welding of Gravity Tanks, Tank Risers & Towers, Dated Jan. 1, 1935—Prepared jointly by A. W. S. and I. A. A.—issued by National Board of Fire Underwriters, 85 John Street, New York.

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● *For further information about the society address: American Welding Society, 29 West 39th Street, New York City, or A. F. Davis, Chairman Membership Committee, P. O. Box 5758, Cleveland, Ohio, or THE WELDING ENGINEER, 608 South Dearborn St., Chicago, Illinois*

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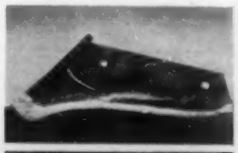

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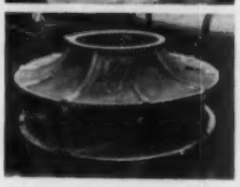

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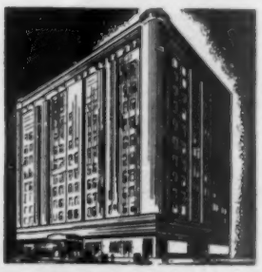

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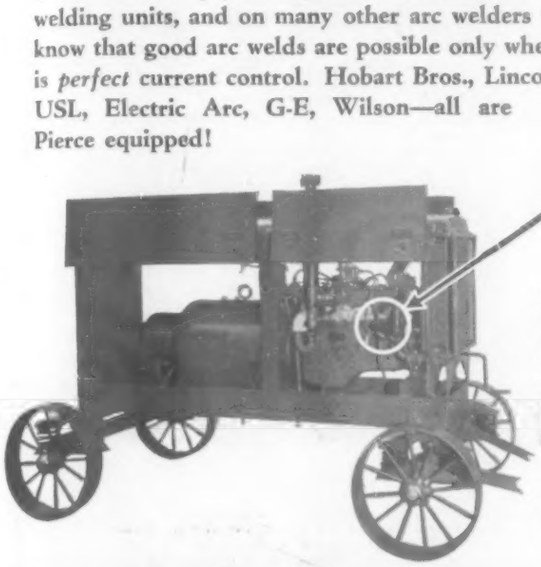

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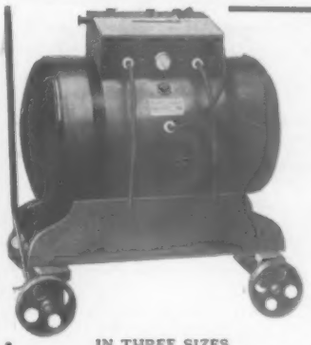

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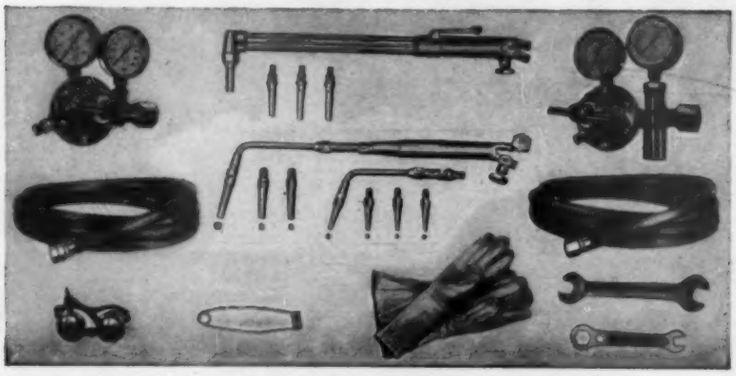

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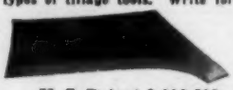

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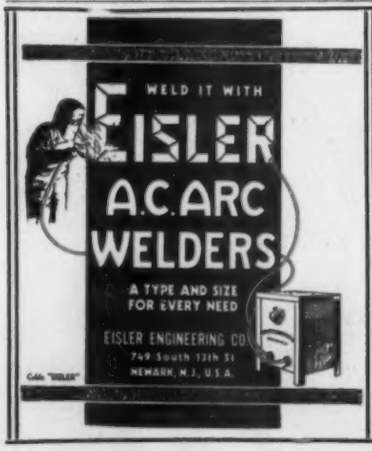

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to all our customers and friends, including competitors, in the welding industry.

We wish to express our appreciation of the business which has made 1936 one of the best in the history of ELECTRIC ARC.

The Electric Arc Company is very grateful for the recognition given its life work; namely, Alternating current and Shielded Arc electrodes, and extends in the Yuletide spirit the suggestion that those who have not availed themselves of its advantages better communicate with the

ELECTRIC ARC CUTTING & WELDING CO.

152-156 JELLIFF AVE. - - - NEWARK, NEW JERSEY